

Math 117Q Fall 2018 Syllabus

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Website: <http://math.oxford.emory.edu/site/math117>

Textbook / Required Materials:

No textbook is required. All notes, practice exercises, assignments and projects will be available at the website above. However, if students wish to have a text for reference, *Elementary Statistics* (either the 11th, 12th, or 13th edition) by Mario F. Triola is a good resource – but this text will not be explicitly addressed in the course.) Students will need access to a computer during class time. Having a flash drive to regularly backup one's work is also highly recommended. Students will need to install and use the R statistical computing package (free at www.r-project.org), Microsoft Excel, and have access to a calculator capable of statistical calculations (recommended models: TI-83, TI-83+, TI-84, TI-84+, or TI-Nspire))

Course Content:

With a focus on applications of classic statistical methods in the natural sciences, this course will cover visual displays of data, elements of experimental design, measures of central tendency and of variability, classification of data, counting, probability, Chebyshev's Theorem, normal distribution, binomial distribution, Central Limit Theorem, hypergeometric distribution, Poisson distribution, Confidence Intervals, Hypothesis testing (means, proportions, variances), Simple linear regression and correlation, Analysis of Variance (one way), Chi Square Tests (Goodness-of-fit, Contingency Tables), Nonparametric methods (Wilcoxon [for independent samples], Kruskal Wallis, Spearman's ρ), as well as practical training in using both R and Excel for data processing and analyses. Emphasis is on inference.

Goals:

Broadly, students should become good consumers of information through their gained knowledge about statistics; become competent in the processes of statistical analysis and inference; and become proficient at doing these things using a variety of tools (e.g., R and Excel). More specifically, students should be able to:

- Categorize data sets;
- Correctly work relevant probability problems;
- Recognize, characterize, and use various discrete and continuous probability distributions (binomial, poisson, hypergeometric, normal, chi-square, F, etc.);
- Analyze data using hypothesis tests involving means, proportions, medians, variances, and rankings, as appropriate;
- Understand the difference between parametric and non-parametric hypothesis tests in relation to inherent assumptions of the general statistical model;
- Discover the limitations of statistics, especially the requirements/assumptions for each hypothesis test covered – often through either experimentation or proof of the underlying principles and results;
- Use hypothesis tests to draw inferences about populations and other real-world phenomena;
- Conduct basic data processing and statistical analysis using both R and Excel; and
- Interpret relationships and conduct hypotheses tests involving bivariate data;

The “Ways of Inquiry” at Oxford:

“Ways of Inquiry” courses are designed to introduce students to the specific ways knowledge is pursued in each discipline through active engagement in the discipline's methods of analysis. INQ courses start with questions,

are student-centered and often collaborative, and they place increasing responsibility on students for their own learning. Students not only experience each discipline's distinctiveness but also move beyond its boundaries to understand connections with other disciplines and fields.

The “Ways of Inquiry” Used in this Course:

This course supports the “Ways of Inquiry” primarily in three ways:

First, the very nature of learning statistics – even sans any special pedagogical devices – teaches students how to explore and resolve questions they have about the world. Through active engagement with the statistical methods associated with data analysis, students will pursue knowledge of what is *true* by quantitatively identifying and rejecting statements that are likely *false*. To do this – and as a core part of this course – students are introduced to the technique of “hypothesis testing”, whereby inferences are made concerning claims about various populations and phenomenon. Students repeatedly will practice the components of hypothesis testing, namely: making an assumption appropriate to a given question posed; examining the results of a related sample or experiment; calculating the probability of seeing the results observed under the assumption made; and then – when such results are sufficiently unlikely – rejecting the aforementioned assumption. This course seeks to get students adept in this process of statistical thinking, especially as it relates to questions and applications related to the natural sciences.

Additionally, in this course, students don't just investigate claims using statistical methods of analysis – they also investigate why these methods work in the first place. Students will actively and collectively discover, through both individual experimentation and class discussions, the motivations behind – and proofs associated with – the theorems that form the basis for the techniques and tools used to do statistical analysis.

Lastly, this course gives students the opportunity to practice statistical inquiry in yet a third way – through specific assignments and projects that involve using both the R computing platform and Microsoft Excel. Students will be given various tasks to accomplish in these two environments (e.g., the simulation of data that matches some criteria; the statistical analysis of data that meet, or fail to meet, certain requirements; the design of experiments whose subsequent analysis reveal causal relationships, etc). All of these tasks will reinforce student understanding and application of the distinctive methods of reasoning connected with statistics. Some will also intentionally connect to interesting problems from mathematics and/or other disciplines. The skills involved in completing these tasks are all either connected to or directly involve programming – an essential tool for any statistician to be able to deal with the “big data” of today's world. Writing any sort of meaningful computer program is, in a very real sense, an act of inquiry. There is no “recipe” one can give to students so charged. On the contrary (and in a quite literal sense) – with every program they write, students “create their own recipe” to accomplish the task in question. Students will attack these tasks in a variety of ways, some elegant, some brutish, but all will have to pull up their sleeves and get down in the trenches of figuring out how this new thing can be done with what they know about these two environments. The instructor's job with regard to this part of the course is to demonstrate the requirements and capabilities of both environments, give students some good guiding principles, and then largely get out of their way – letting them discover how to use these environments to do what they want to do. Seeking to foster the skills related to healthy collaboration in their inquiry and analysis, students will have the opportunity to pair up with other students as they engage in many of these tasks.

Attendance:

Students are responsible for all work covered in class. They are expected to attend all classes and be present for all scheduled tests. Any conflicts should be brought to the instructor's attention as soon as possible.

Grading:

Grades will be determined by student performance on class and lab quizzes, tests, assignments, projects, and a comprehensive final exam, as follows:

Class Quizzes (2 @ 25 pts each)	50 pts
Tests (4 @ 100 pts each)	400 pts
Lab Assignments (2 @ 25 pts each)	50 pts
Lab Quizzes (2 @ 25 pts each)	50 pts
Lab Test	100 pts
Inquiry-Based Projects (3 @ 50 pts each)	150 pts
Final exam	200 pts
Total:	1000 pts

In general, a 10% scale will be used to determine letter grades (e.g. A's for scores of 900 or above, B's for scores between 800 and 899 points, etc.) Exact cut-off scores for +/- grades will be determined by the distribution of totals for all students, and at the discretion of the instructors.

Tests and Final Exam:

Unless unusual circumstances require a change, tests will be given during class time on dates that will be announced through Canvas. Students may use their calculators for certain portions of tests, experiments, and the final exam, as indicated by the instructors. Students are expected to take tests at the scheduled times. If a legitimate reason exists for missing a test – as determined by the instructor – then the test must be taken prior to the regularly scheduled date. In the unusual circumstance where taking the test early is not possible, the percentage grade earned on the final exam will be used as the missed test grade. Students must provide written documentation in advance of any special accommodations required for testing. This includes additional time or other needs.

The final exam is cumulative and will be given at the time designated on the college's final exam schedule. Students must obtain the permission of the Senior Associate Dean of academic affairs to take a final exam earlier or later than scheduled. Permission is normally granted for documented family emergencies, documented medical reasons, or for participation in educational programs. Permission will also be granted for students scheduled to take three exams on a single calendar day (not three exams within a general twenty-four-hour period). Students with three exams on one calendar day must document their situation with the Senior Associate Dean no later than 5:00 p.m. on Reading Day. Students in this situation will be granted permission to work with one of their instructors to arrange to take one of their exams at an alternate date and time within the official exam week. Leaving early for rides or flights, vacations, relatives' or friends' weddings or graduations, jobs, or having two exams on one day, and other situations, are not considered valid reasons to request an earlier or later exam date.

Class Quizzes, Lab Assignments and/or Quizzes, and Projects:

Class quizzes will focus on traditional statistics content, while lab quizzes and the lab test will focus on how to use R and Excel in statistical contexts.

Lab assignments and projects are intended to not only reinforce the basic statistical concepts taught during class, but also to engage students with processing data and doing statistical analysis in the contexts of R and Excel. Due dates and times for all assignments and projects will be specified online, through Canvas. A tentative schedule of lab quizzes will be posted on Canvas as well.

In general, late projects will not be accepted and make-up quizzes will not be offered. This policy will be waived only in an "emergency" situation at the instructor's discretion, and only after any documentation the instructor requires has been provided.

Homework:

Homework problems will not be collected but are assigned to benefit the student. Each student should work the problems in the materials provided online until they feel confident in their understanding of the material. To do well, the average student should plan on studying and doing practice problems for about 3 hours outside of class for each class meeting held. Preparing assignments, projects, and reviewing for tests will require more time.

Finding Help:

- There is a class conference on Canvas in addition to the aforementioned class website at <http://math.oxford.emory.edu/site/math117>. Students should consult both of these resources frequently for announcements about test and quiz dates, project due dates, office hours, SI sessions, homework assignments, class notes, review material, etc.
- Office hours will be posted on Canvas by the instructors. Students can use this time to come by and ask specific questions related to this course and/or homework problems. In addition, students may email instructors.
- There are SI (Supplemental Instructor) student leaders attached to this course that will schedule review sessions each week. These sessions are optional – however each student is encouraged to pick one of the times per week and attend regularly. Note, students who attend SI sessions on a regular basis generally end up performing better in the course.
- Student tutors are available for one-on-one assistance with the material in the Math Center in Pierce Hall.
- Study groups organized by students have historically been very beneficial, as well. To be effective, meetings should be scheduled weekly and should be part of a regular weekly routine.

Special Accommodations:

The Office of Accessibility Services (OAS) works with students who have disabilities to provide reasonable accommodations. In order to receive consideration for reasonable accommodations, please contact the OAS and complete the registration process. Faculty may not legally provide you with accommodations until an accommodation letter has been processed and discussed with them; accommodations do not start until this point and are not retroactive. Students registered with OAS who receive a letter outlining specific academic accommodations are thus strongly encouraged to immediately coordinate a meeting with their professors to discuss a protocol to implement accommodations that will (or may) be needed over the course of the semester. This meeting should occur as early in the term as possible. Contact Megan Bohinc in OAS for more information at (770) 784-4690 or oas_oxford@emory.edu

HONOR CODE (see <http://oxford.emory.edu/catalog/regulations/honor-code.html>)

THE HONOR CODE APPLIES TO ALL WORK SUBMITTED FOR CREDIT TOWARDS YOUR GRADE. ALL HAND-WRITTEN WORK WILL BE PLEDGED TO BE YOURS AND YOURS ALONE THROUGH YOUR SIGNATURE. PROJECT WORK WILL BE PLEDGED TO BE THE WORK OF ONLY YOU AND AN IDENTIFIED PARTNER (WHEN APPLICABLE) UPON SUBMISSION ONLINE.

Note: Student work submitted as part of this course may be reviewed by Oxford College and Emory College faculty and staff for the purposes of improving instruction and enhancing Emory education.