

Mathematical Statistics
Math 376, Spring 2017

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Office Hours:	Monday 2:00PM – 4:00PM, Wednesday 1:00PM – 3:00PM, Thursday 1:00PM – 4:00PM, and by appointment
Class Hours:	Monday, Wednesday, Friday 12:00-12:50AM
Room:	Swords 328
Textbook:	<i>Mathematical Statistics with Applications, 7th Edition</i> by Wackerly, Mendenhall, and Scheaffer
Course Website:	Moodle
Prerequisites:	Math 375 (Probability Theory)

Welcome back to Probability and Statistics! This is the second half of a two semester sequence which will introduce you to the mathematical underpinnings of probability and statistical inference. On their own, each course counts as a 'Statistics' course with respect to the breadth requirement of the mathematics major. Whereas the first semester focused almost entirely on probability theory, this semester will instead concentrate on statistical inference.

At the end of this semester, you will be able to:

- 1) Understand the variation inherent to a sample from a population.
- 2) Make inferences about a variable in question (confidence intervals and hypothesis tests).
- 3) Become familiar with statistical software and writing mathematical documents.
- 4) Use the techniques developed in class to perform your own statistical analysis.

The course calendar that follows will briefly describe each of the topics that we will cover. The class will, for the most part, follow the textbook, *Mathematical Statistics with Applications, 7th Edition* by Wackerly, Mendenhall, and Scheaffer. Although not enforced, class attendance and reading of the designated sections of the text are highly recommended. The textbook provides a very good explanation of the topics that we are going to cover this semester and therefore will help your understanding of these topics. The grade you earn will be a reflection of how well you have mastered the material in this course and will be based upon the following five criteria:

1) Homework Assignments (15%): Weekly homework assignments will be given. I truly believe that the only way to learn statistics (and mathematics, in general) is to *do* statistics. A majority of the problems will be drawn from the book, although I may incorporate some of my own questions. You are permitted (an encouraged!) to work with your classmates on these assignments. However, each student is

expected to turn in their own set of solutions. To receive full credit, solutions to homework assignments should be clearly written on the provided worksheet and have all relevant work organized in the proper sequence. Homework assignments will be due on Mondays by 4PM. Late homework assignments will not receive full credit and homework more than one day late will receive no credit.

2) Quizzes (10%): Quiz questions will be drawn only from the material covered in the homework assignment submitted that week (i.e. quizzes are not cumulative) and will resemble those seen on homework assignments. This semester, quizzes will be take-home and due at the start of class on Friday.

3) Two Exams (40%): There will be two exams during the semester. The exams will not be exercises in memorization, but will try to be written so that students with a solid understanding of the concepts should have little, if any, trouble. The first exam is tentatively set for **Friday March 3rd**, the second for **Wednesday April 19th**. There are no make-ups allowed on exams.

4) Community-Based Learning (CBL) Project (15%): This semester we will be working with the Worcester County Food Bank and the Community Harvest Project to design and then analyze the results of a survey of their partner organizations. On Friday, I'll give you background information about the data to be collected and then we will spend the rest of the class brainstorming appropriate questions to collect the desired information. In the weeks that follow, you will work on collecting the data and providing summary results. At the end of the semester, I'm hopeful that the class can give a formal presentation of our findings to representatives of the Worcester County Food Bank and the Community Harvest Project. There are several different topics each organization wants information about, so the class will be broken into groups and each group will write questions and then analyze the results for a particular group of questions. You will be graded based on the questions you create, the analysis performed, and the quality of your presentation. Additional project details will be provided throughout the semester.

5) Final Exam (20%): The date and time of the comprehensive final examination are set by the Registrar's office. Once this information becomes available, I will let you know. There are no make-ups or other alterations to the timing of the final exam allowed.

Should you ever need help with this course, there are two great options available to you:

- 1) Ask a classmate for help
- 2) Stop by my office during office hours or make an appointment to see me

Additional Course Policies:

Academic Integrity: A student found cheating on an examination or assisting others in the course of an examination will receive an F for the course and will be subject to further sanctions. Copying another student's assignment is considered cheating and will result in receiving a 0 for that assignment. As previously stated, you are encouraged to work together on homework assignments. However, each student is expected to write out their own solutions. For more information, please see the College's

Academic Honesty Policy, which can be found at <http://catalog.holycross.edu/node/1381#AHP>. Additionally, the Mathematics and Computer Science department has its own Academic Integrity policy that all of you signed in the fall semester.

Information for Students with Disabilities: Holy Cross is committed to providing all students with equal access to learning. If you think you have a disability requiring accommodations, you must register with the Office of Disability Services, located in room 215A of the Hogan Campus Center (x3693) in order to receive reasonable accommodations in this course. Once a disability is officially documented at Holy Cross by this office, and with your permission, instructors will receive letters outlining the reasonable accommodations they are required to make. Once I have received this letter, you and I should meet to coordinate the way these will be implemented in this course. For more information, go to <http://www.holycross.edu/health-wellness-and-access/office-disability-services>

Cell Phones: Texting and/or playing games during class will hinder your ability to learn. As a deterrent, the first offense will be a warning, the second will result in dismissal from class for the day, and the third will result in a much longer suspension from class. In short, turn your cell phones off during class.

Calculators: A calculator is highly recommended but not required. You do not need to go out and buy a graphing calculator - a basic calculator will be sufficient for our course. Using your cell phone as a calculator is not permitted since phones are meant as communication devices (See Academic Integrity and Cell Phone policies above).

Grading: Final grades will be given according to the following percentage cutoffs. These cutoffs, although fairly strict, can be lowered (according to class performance), but not raised, no matter how well the class performs

Final Grade	Percentage
A	93 to 100
A-	90 to <93
B+	87 to <90
B	83 to <87
B-	80 to <83
C+	77 to <80
C	73 to <77
C-	70 to <73
D+	67 to <70
D	63 to <67
F	0 to <63

Course Calendar (subject to change)

Date	Section	Topic	Notes
Jan 25 – W		Syllabus; Sampling Strategies	
Jan 27 – F		Survey Design for CBL Project	
Jan 30 – M	1.1-1.2	Graphical Displays (Lab)	
Feb 1 – W	1.3-1.6	Measures of Center and Spread	
Feb 3 – F	1.3-1.6	Measures of Center and Spread, cont.	
Feb 6 – M	7.1	Statistics and their Sampling Distributions	HMWK #1 Due

Feb 8 – W	7.3	The Central Limit Theorem	
Feb 10 – F	7.5	Normal Approximation to the Binomial	Quiz #1
Feb 13 – M	7.2	The Chi-Square Distribution	HMWK #2 Due
Feb 15 – W	7.2	The T and F Distributions	
Feb 17 – F	8.1-8.2	Introduction to Point Estimation: Bias and Mean Square Error	Quiz #2
Feb 20 – M	9.2, 9.3	Efficiency and Consistency	HMWK #3 Due
Feb 22 – W	9.4	Sufficiency	
Feb 24 – F	9.4, 9.5	Sufficiency, cont.; MVUE	Quiz #3
Feb 27 – M	9.5	The Rao-Blackwell Theorem	
Mar 1 – W	9.7	Maximum Likelihood Estimation	
Mar 3 – F		Exam #1 – Chapters 1, 7, 8.1-8.2, and 9.1-9.5	
Mar 4-Mar 12		No Class! Spring Break	
Mar 13 – M	8.3-8.5	Interval Estimates	HMWK #4 Due
Mar 15 – W	8.3,8.6-8.7	Large Sample Confidence Intervals: Means	
Mar 17 – F	8.3,8.6-8.7	Large Sample Confidence Intervals: Proportions	Quiz #4
Mar 20 – M	8.3,8.6-8.7	Large Sample Confidence Intervals: Two Sample Problems	HMWK #5 Due
Mar 22 – W	8.8	Small Sample CI for μ ; The t-Distribution	
Mar 24 – F	N/A	The Bootstrap [Lab]	Quiz #5
Mar 27 – M	N/A	Bootstrap Confidence Intervals [Lab]	HMWK #6 Due
Mar 29 – W	10.1	Introduction to Hypothesis Testing	
Mar 31 – F	10.1,10.4	Errors in Hypothesis Testing	Quiz #6
Apr 3 – M	10.3	Large Sample Hypothesis Tests – Proportion	HMWK #7 Due
Apr 5 – W	10.3	Large Sample Hypothesis Tests – Mean	
Apr 7 – F	10.3	Large Sample Hypothesis Test Involving Two Samples	Quiz #7
Apr 10 – M	10.8	Small Sample Hypothesis Tests for μ ; The t-Distribution	
Apr 12 – W	10.8	Small Sample CI and Hypothesis Tests for $\mu_1 - \mu_2$	
Apr 13 - 17		No Class! Easter Break	
Apr 19 – W		Exam #2 – Chapters 8, 10, and Section 9.7	
Apr 21 – F	10.6	P-Values	
Apr 24 – M	12.3	Matched Pairs Analysis	
Apr 26 – W		No Class – Academic Conference Day	
Apr 28 – F	11.1	Intro to Linear Regression	
May 1 – M	11.3	Least Squares Estimation	HMWK #8 Due
May 3 – W	11.4	Properties of Least Squares Estimators;	
May 5 – F	11.10 11.5-11.6	Multiple Regression and Matrix Formulation Hypothesis Testing of Regression Coefficients	Quiz #8
May 8 – M		Project Day	

Final Exam: TBA [On or before Wednesday May 17th]