

Probability Theory Stat 375, Fall 2019

Professor:	Eric Ruggieri
Office:	325 Swords Hall
Phone:	(508) 793-2400
E-mail:	eruggier@holycross.edu
Office Hours:	Monday, Wednesday, and Thursday 1:00PM-3:00PM, Tuesday 2:00PM – 4:00PM, and by appointment
Class Hours:	Tuesday and Thursday, 11:00AM-12:15PM
Room:	223 Stein Hall
Textbook:	<i>Mathematical Statistics with Applications, 7th Edition</i> by Wackerly, Mendenhall, and Scheaffer
Course Website:	Moodle
Prerequisites:	Math 241 (Multivariable Calculus)

Welcome to Stat 375: Probability Theory! [Formerly Math 375] This is the first half of a two semester sequence which will introduce you to probability and statistical inference. This semester will focus almost entirely on the foundations of mathematical probability. The second half of the course, Stat 376: Mathematical Statistics is based on these probabilistic ideas and is generally offered every spring semester. One of the great things about this course [besides the material] is that 100% of the material that we cover is preparation for the first actuarial exam [P]. If you haven't considered a career in the actuarial sciences, or don't quite know what an actuary is, visit www.beanactuary.org and take a look!

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

- 1) Calculate the probability of an event using the basic axioms of probability as well as through the use of probability distributions
- 2) Find expected values of random variables
- 3) Use moment generating functions to describe a random variable
- 4) Analyze functions of random variables, including pairs of random variables
- 5) Understand the variation inherent to a sample from a population

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 [see Student Attendance at Class and Excused Absence Policy: <https://hccatalog.holycross.edu/requirements-policies/academic-policies/#coursepoliciestext>]. 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 four criteria:

1) Homework Assignments (20%): 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 Tuesday afternoons by 4PM. Late homework assignments will not receive full credit and homework more than one day late will receive no credit.

2) Weekly Quizzes (20%): A brief quiz will be given on Thursday of each week during the first 15 minutes of class. The quiz questions will be drawn only from the material covered in the homework assignment submitted the previous class period (i.e. quizzes are not cumulative) and will resemble those seen on homework assignments. If necessary, quiz make-ups must be complete by the time quizzes are handed back at the start of the next class period unless prior arrangements have been made.

3) Two Midterm Exams (40%): There will be two exams during the semester. The exams will be held at night, with the exact date set based on class availability (i.e. when the greatest number of students are available). 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 **Wednesday October 9th**, the second for **Wednesday November 20th**. There are no make-ups allowed on exams.

4) Final Exam (20%): The date and time of the comprehensive final examination will be announced by the Registrar's office. I will let you know once this information becomes available. 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 <https://catalog.holycross.edu/requirements-policies/academic-policies/#academicintegritytext>. Additionally, the Mathematics and Computer Science department has its own Academic Integrity policy that I will pass out for all of you to read and sign.

Information for Students with Disabilities: The College of the Holy Cross is committed to providing all students with equal access to learning. Any student who feels the need for accommodation based on the impact of a disability should contact the Office of Accessibility Services to discuss support services available. Once the office receives documentation supporting the request for accommodation, the student would meet privately with Accessibility Services to discuss reasonable and appropriate accommodations. Then, with your permission, each instructor will receive a letter (delivered by you) 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. The Office of Accessibility Services can be reached by calling 508-793-3693 or by visiting Hogan Campus Center, room 505. For more information, go to <https://www.holycross.edu/health-wellness-and-access/office-accessibility-services>

Respect for Diversity: It is my intent that students from all diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that the students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender identity, sexuality, disability, age, socioeconomic status, ethnicity, race, nationality, religion, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally, or for other students or student groups. In particular, if a situation causes you discomfort or offense, please feel free to:

- i) Discuss the situation privately with me. I am always open to listening to students' experiences, and want to work with students to find acceptable ways to process and address the issue.
- ii) Discuss the situation with the class. Chances are there is at least one other student in the class who had a similar response to the material.
- iii) Notify me of the issue through another source such as your academic advisor, a trusted faculty member, or a peer. If for any reason you do not feel comfortable discussing the issue directly with me, I encourage you to seek out another, more comfortable avenue to address the issue.

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. In fact, graphing calculators will not be allowed on quizzes or exams. 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
Sept 5 – R	2.1-2.2	Syllabus; Overview of Course Samples Spaces and Events	
Sept 10 – T	2.3 2.4-2.5	Review of Set Theory Probability Axioms and Properties	
Sept 12 – R	2.6	Counting Techniques	
Sept 17 – T	2.7-2.9	Envelopes Problem Conditional Probability; Independence; Laws of Probability	HMWK #1 Due
Sept 19 – R	2.10	Law of Total Probability and Bayes' Rule	Quiz #1
Sept 24 – T	2.11 3.1-3.2 3.3	Discrete Random Variables (RV) Probability Mass Functions, CDFs Expected Values: Discrete RV	HMWK #2 Due
Sept 26 – R	3.3	Expected Values of Functions; Variance of a Discrete RV	Quiz #2
Oct 1 – T	3.4	The Binomial Distribution	HMWK #3 Due
Oct 3 – R	3.5-3.7	Negative Binomial, Geometric, and Hypergeometric Dist.	Quiz #3
Oct 8 – T	3.8	Poisson Distribution Review for Exam	
Oct 9 – W	2.1-3.8	Exam #1 – Chapters 2 & 3	
Oct 10 – R	4.1-4.2, 4.4	Introduction to Continuous RVs Probability Density Functions (pdf) Cumulative Distribution Functions (CDF)	
Oct 12 - Oct 20		No Class! Fall Break!	
Oct 22 – T	4.3	Expected Value and Variance of a Continuous RV Moment Generating Functions	HMWK #4 Due
Oct 24 – R	3.9 4.9	Moment Generating Functions: Discrete RVs Moment Generating Functions: Continuous RVs	Quiz #4
Oct 29 – T	4.5	Normal Distributions	HMWK #5 Due

Date	Section	Topic	Notes
Oct 31 – R	4.6	The Gamma, χ^2 , and Exponential Distributions	Quiz #5
Nov 5 – T	4.7 3.11, 4.10	Beta Distribution Chebyshev's Inequality	HMWK #6 Due
Nov 7 – R	5.1-5.2 5.9	Joint Distributions: Discrete Joint Distributions: Continuous The Multinomial Distribution	Quiz #6
Nov 12 – T	5.3 5.4	Marginal Distributions Independence of RVs	HMWK #7 Due
Nov 14 – R	5.5-5.6 5.7	The Expected Value of a Function of RVs Covariance of Two RVs	Quiz #7
Nov 19 – T	5.7	Correlation of Two RVs Review for Exam	
Nov 20 – W	4.1–5.7, 5.9	Exam #2 – Chapters 4 & 5	
Nov 21 – R	5.3	Conditional Probability Distributions	
Nov 26 – T	5.11	Conditional Expectation and Variance	
Nov 27 – Dec 1		No Class! Thanksgiving Break	
Dec 3 – T	5.8	Linear Combinations of Random Variables	
Dec 5 – R	6.1-6.3	Transformation of a RV: The CDF Method	HMWK #8 Due
Dec 10 – T	6.4	Transformation: The Change of Variables Theorem	Quiz #8
Dec 12 – R	6.7 7.3	Order Statistics The Central Limit Theorem	HMWK #9 Due Last Day of Class

Final Exam: TBA [on or before Saturday December 21st]