

# Probability



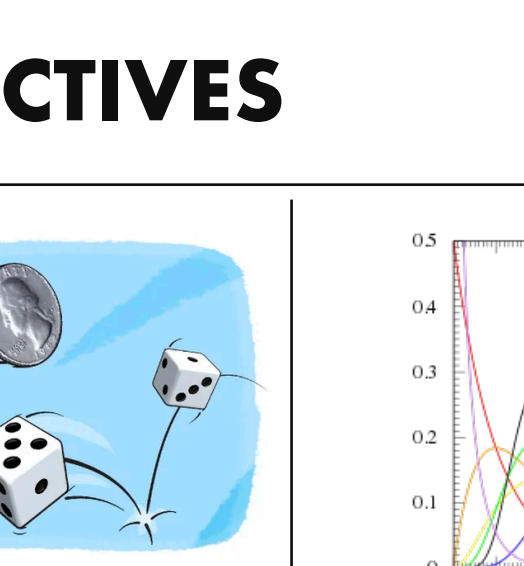
MTH 357/657

**Dr. John Gemmer:** gemmerj@wfu.edu  
**Office:** Manchester 388  
**Course Website:** <http://users.wfu.edu/gemmerj/math357-657S23.html>  
**Canvas:** The course syllabus and grades will be posted on Canvas  
**Office Hours:** T 10:00-11:00, W 12:00-2:00, Th 1:00-3:00  
**Class Meeting Times:** MWF 9:00-9:50  
**Class Location:** Greene Hall, Room 321

## COURSE DESCRIPTION

An introduction to the mathematical theory of probability from an applied mathematics perspective. Probability is the branch of mathematics concerning numerical descriptions of how likely an event is to occur, or how likely a proposition is to occur. Probability can be thought of as a mathematical model for processes with uncertainty or are so complicated that randomness serves as a good proxy for processes which cannot be realistically measured. For example, when predicting the weather it is not possible to measure the state of every air molecule and instead we make predictions based off measurements from a small number of variables, e.g. temperature, humidity, and pressure. In this course, while we will learn mathematical concepts such as random variables, distributions, expected values, etc., we will also apply these concepts to numerous examples drawn from many areas of science and industry. While I am not a statistician, one of my goals with this course is to prepare students for the advanced concepts that arise in our 300 level statistics courses.

## REQUIREMENTS

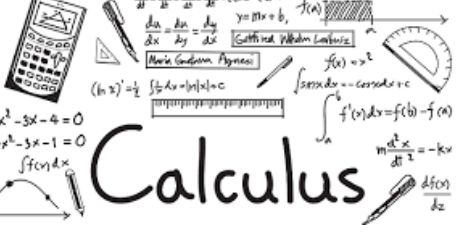


**Prerequisites:**  
Calculus II or MTH 205



**Textbook:**  
Mathematical Statistics with Applications

## OBJECTIVES



**Master discrete probability theory**



**Master continuous probability theory**



**Apply theory to applications**



**Reinforce skills in calculus**

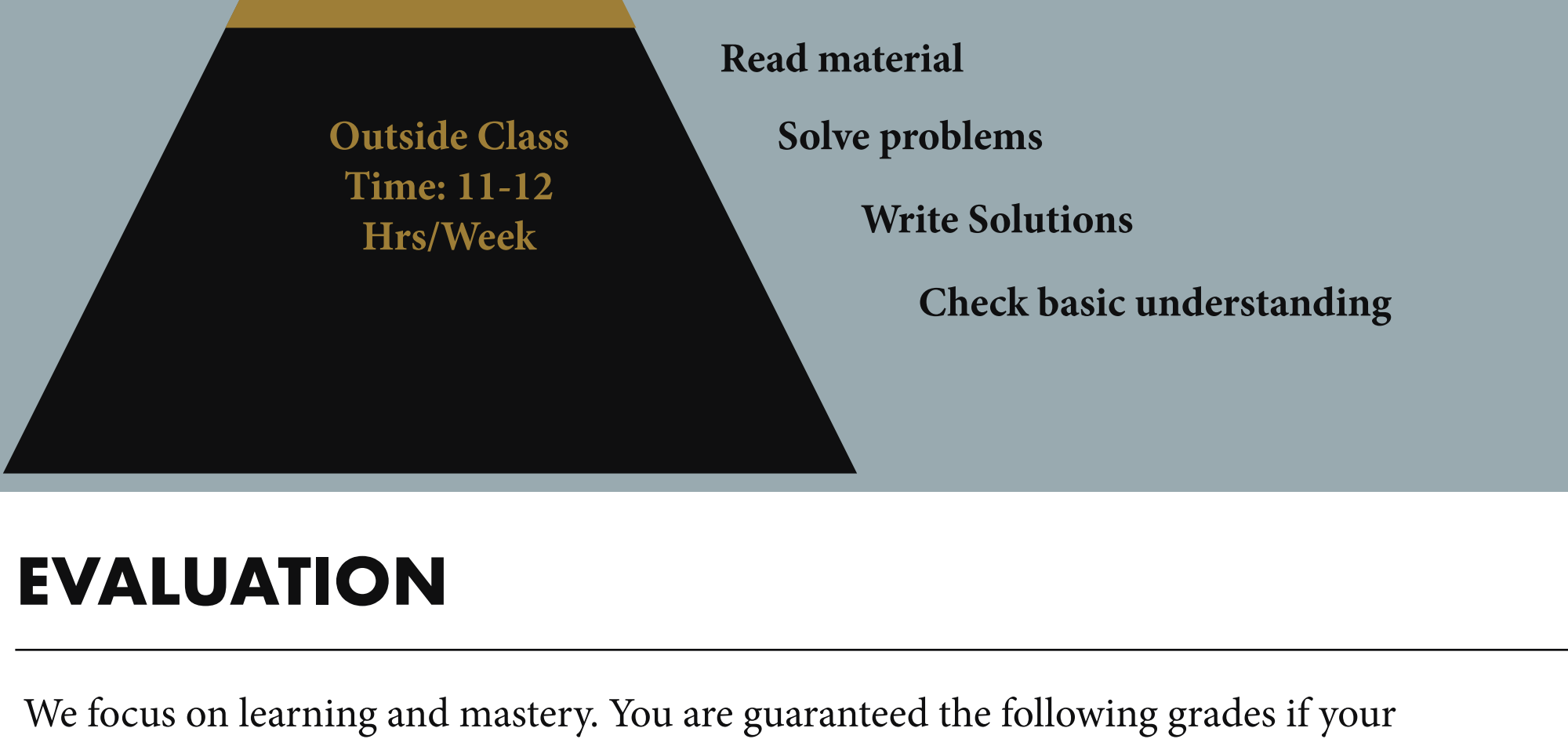


**Learning to collaborate**



**Write Effectively**

## CLASS STRUCTURE



## EVALUATION

We focus on learning and mastery. You are guaranteed the following grades if your final percentage lies within the following ranges:

90-92.9: A-	93-100: A	
80-82.9: B-	83-86.9: B	87-89.9: B+
70-72.9: C-	73-76.9: C	77-79.9: C+
60-62.9: D-	63-66.9: D	67-69.9: D+

**Classworks (5%)**  
Structured in class group assignments  
Grades based on attendance

**Quizzes (10%), at least 1 dropped**  
5-10 minutes  
In class on most Fridays

**Weekly Homework (25%), at least 1 dropped**  
Open book, collaboration allowed with citation  
Homework is due on Friday in class

**Two summative assessments (30%)**  
In class, closed notes

**Final Exam (30%)**  
Comprehensive  
In class, closed notes

**Classworks:** Throughout the course there will be several announced and unannounced class works. These consist of structured group assignments that will be completed during class time. These assignments will generally be exploratory allowing students to synthesize concepts through a “hands on” approach. Classworks will be graded based on attendance.

**Quizzes:** On most Fridays there will be a short 5-10 minute in-class quizzes. These quizzes will consist of a very short problem that will test your knowledge of the prior lectures and homework. These quizzes are to help both the students and the instructor understand concepts that students may be struggling with. All quizzes will be announced in class. There will be no “pop” quizzes. There are no retakes for missed quizzes, however I will drop the lowest quiz score from your final grade.

**Weekly Homework:** Homework will be assigned most weeks on Friday and will be due Friday in class the following week. Late homework will not be accepted under any circumstances. However, I will drop at least one homework assignment from your grade. While you are allowed to collaborate with your colleagues, homework must consist of solutions that show all steps, be your own work and be written clearly using complete sentences as appropriate (see homework policy). All homework will be submitted in class on paper. I will not accept digital versions of your homework.

**Summative Assessments:** There will be two in class summative assessments in the course and a cumulative final exam.

**Late Work Policy:** Except in very extreme circumstances, I do not accept late assignments or reschedule exams. If you have a situation in which you cannot make an exam for personal reasons, you must arrange accommodations with the instructor to schedule the exam **before the scheduled exam date**. If you have a legitimate emergency situation, I will make sure that all students in the course will have access to the same exception to this policy.

**If you need to miss class due to a university sponsored activity, such as athletics. Please contact the faculty member as soon as possible to reschedule due dates.**

## COURSE ENVIRONMENT

### Names/Pronouns

You **deserve** to be addressed in the manner you prefer. To guarantee that I address you properly, you are welcome to tell me your pronoun(s) and/or preferred name at any time, either in person or via email.

### Diversity

We embrace diversity of age, background, beliefs, ethnicity, gender, gender identity, gender expression, national origin, religious affiliation, sexual orientation, and other visible and non-visible categories. I **do not tolerate discrimination**.

### Accessibility

I want you to succeed in this course. Wake Forest University provides reasonable accommodations to students with disabilities. If you are in need of an accommodation, then please contact me privately as early in the term as possible. Retroactive accommodations may not be provided. Students requiring accommodations must also consult the Center for Learning, Access, and Student Success(118 Reynolda Hall, 336-758-5929, <http://class.wfu.edu>). For personal issues, stress, health problems or life circumstances see [shs.wfu.edu/](https://shs.wfu.edu/). Contact me if you have other special circumstances. I will find resources for you.

### Title IX

You **deserve** a community free from discrimination, sexual harassment, titleix.wfu.edu/.

### Emergency Fund

You **deserve** a learning environment in which all of your physiological and safety needs are met. If you are experiencing situations in which these needs are not met, e.g. you do not have adequate housing or sufficient food security, the Chaplain's Office has an emergency fund which can provide support: <https://chaplain.wfu.edu/care-support/chaplains-emergency-fund/>. In situations in which you need immediate assistance there is emergency funding available through the Department of Mathematics and Statistics. If you are in need of emergency help you are encouraged to reach out to a faculty member in the Department of Mathematics and Statistics who will work with the chair of the department to address your needs.

### Course Resources

The department has a limited amount of funding for class materials. If you cannot afford class materials, you are encouraged to contact the chair of the department privately as early in the term as possible. Due to the limited amount of funds, students must exhaust all other sources of funding before applying to the department for assistance.

### The Honor Code

At Wake Forest, we expect you to behave as honorable citizens of the class, the university, and the world as a whole. When you complete an assignment with your name on it, you are representing that everything you are turning in is your own work. That means that you do not copy from other students, textbooks, or websites. If at that time I become aware of cheating or plagiarism in this course, I will submit the information to the honor council.

## TENTATIVE COURSE CALENDAR

### Basics of Discrete Probability

- Week 1:  
 1. 1/09: Going over the syllabus, introduction, and motivation, **Sections 2.1-2.2**  
 2. 1/11: Set theory, **Sections 2.3-2.4**  
 3. 1/13: Events and probability, **Sections 2.4-2.5**
- Week 2:  
 1. 1/16: **Martin Luther King Jr. Day**.  
 2. 1/18: Counting and probability part 1, **Section 2.6**  
 3. 1/20: Counting and probability part 2, **Section 2.6, Homework #1 Due**
- Week 3:  
 1. 1/23: Conditional probability and independence, **Sections 2.7-2.8**  
 2. 1/25: Event composition method, **Section 2.9**  
 3. 1/27: **Quiz #1, Classwork #1, Homework #2 Due**
- Week 4:  
 1. 2/03: Probability distributions for discrete random variables, **Section 3.2**  
 2. 2/01: Expected value and variance, **Section 3.3**  
 3. 2/03: Binomial distribution, **Section 3.4, Quiz #2, Homework #3 Due**
- Week 5:  
 1. 2/06: Geometric distribution, **Section 3.5**  
 2. 2/08: **Classwork #2**  
 3. 2/10: **Summative Assessment #1 on Sections 2.1-3.3**

### Discrete and Continuous Distributions

- Week 6:  
 1. 2/13: Negative binomial distribution, **Section 3.6**  
 2. 2/15: Hypergeometric distribution, **Section 3.7**  
 3. 2/17: **Quiz #3, Classwork #3, Homework #4 Due**
- Week 7:  
 1. 2/20: Poisson distribution, **Section 3.8**  
 2. 2/22: Moment generating functions and Tcebysheff's theorem, **Sections 3.9, 3.11**  
 3. 2/24: Probability distributions, **Sections 4.1-4.2, Quiz #4, Homework #5 Due**
- Week 8:  
 1. 2/27: Expected values and uniform distribution, **Sections 4.3-4.4**  
 2. 3/01: Normal distributions, **Section 4.5**  
 3. 3/03: Gamma distributions, **Section 4.6 Quiz #5, Homework #6 Due**

**Spring Break: 3/06-3/10**

- Week 9:  
 1. 3/13: Beta distributions, **Section 4.7**.  
 2. 3/15: Other expected values and Tcebysheff's theorem, **Sections 4.9-4.10**  
 3. 3/17: **Quiz #6, Classwork #4, Homework #7 Due**
- Week 10:  
 1. 3/20: Bivariate and multivariate distributions, **Section 5.2**  
 2. 3/22: Marginal and conditional probability distributions, **Section 5.3**  
 3. 3/24: **Summative Assessment #2 (Sections 3.4-4.10)**

### Multivariate Distributions and Functions of Random Variables

- Week 11:  
 1. 3/27: Independent random variables, **Section 5.4**  
 2. 3/29: Expected value of functions of random variables, **Section 5.5**  
 3. 3/31: **Quiz #7, Classwork #5, Homework #8 Due**
- Week 12:  
 1. 4/03: Special theorems, **Section 5.6**  
 2. 4/05: Covariance of two random variables, **Section 5.7**  
 3. 4/07: **Quiz #7, Classwork #6, Homework #9 Due**
- Week 13:  
 1. 4/10: Expected value and variance of linear combinations, **Section 5.8**  
 2. 4/12: Multinomial probability distribution, **Section 5.9**  
 3. 4/14: **Quiz #8, Classwork #7, Homework #10 Due**
- Week 14:  
 1. 4/17: Conditional expectations, **Section 5.11**  
 2. 4/19: Finding the probability distribution of a function of random variables, **Sections 6.2-6.3**  
 3. 4/21: Method of transformations, **Quiz #9, Homework #11 Due**
- Week 15:  
 1. 4/24: **Classwork #8**  
 2. 4/26: **Classwork #9**

**Final Exam: 5/05, 9:00 AM.**

## SUCCESS



Attend class



Participate constantly



Invest time



Concentrate on concepts in addition to calculations



Seek help when needed



Eliminate Virtual Distractions