

Statistics 414 – Mathematical Statistics I
Section 500, Fall Term, 2019

This course is the first of a two-semester sequence in mathematical statistics. Topics include basic probability, random variables and their distributions, functions of random variables, expectation and variance, moment generating functions, conditional distribution and expectation, and statistical limit theorems.

Course Information

Time and Place:	MWF 9:10am–10:00am, Blocker 150.
Instructor:	Daren Cline (dcline@stat.tamu.edu), Blocker 459D, 845-1443.
Office Hours:	MWF 10:20am–11:20am, or by appointment.
Grader:	Jianing Dong (—@stat.tamu.edu). See eCampus for office hours. <i>The grader will not accept homework from students; please bring it to me.</i>
eCampus:	Lecture notes and homework assignments will be available in eCampus.
Textbook:	John A. Rice, <i>Mathematical Statistics and Data Analysis, 3rd ed.</i> , Duxbury (Cengage).
Prerequisite:	Mathematics 221, 251 or 253 (multivariable calculus).
Course Objectives:	By the end of the semester, students will be expected <ul style="list-style-type: none">• to understand and apply the basic principles of probability,• to interpret and use conditional probability, and to understand independence,• to know the definitions of random variable and distribution,• to be familiar with common distributions, both discrete and continuous,• to know how to obtain or compute probabilities, expectations, variances and generating functions for various types of random variables,• to understand random vectors and multivariate distributions, and to work with them,• to find distributions of functions of random variables and random vectors, and• to use and apply the basic limit theorems of probability.
Homework:	Homework will be assigned (in eCampus) and collected regularly. Homework is worth 20% of the total term score. <i>Please see the homework policy below.</i>
Exams:	Two midterm exams worth 20% each, and a final exam worth 40%. <i>Please see the exam policy below.</i>
Exam Dates:	Exam I: Wednesday, 9 October (tentative). Exam II: Monday, 4 November (tentative). Final Exam: Monday, 9 December, 8:00am–10:00am. Students may not take the final exam early; so please do not even ask.
Grade Scale:	A: 85%, B: 72.5%, C: 60%, D: 50%. (These are firm, without rounding.)
Disabilities Help:	The Americans with Disabilities Act ensures that students with disabilities have reasonable accommodation in their learning environment. If you have a disability and need help, please contact me and Disability Services in the Student Services at White Creek complex, 845-1637.
Academic Integrity:	You are expected to maintain the highest integrity in your work for this class, consistent with the university rules on academic integrity . This includes not passing off anyone else's work as your own, even with their permission. Please see the homework and exam policies below for specifics.
Copyright:	Each document provided for this course is copyrighted with all rights reserved, whether or not the document explicitly states so. They may only be used for academic purposes and they may not be reproduced, sold or distributed without my permission.

Course Policies

Homework Policy:

Your homework solutions must be your own work, not from outside sources, consistent with the university rules on **academic integrity**. I expect you to follow this policy scrupulously. *Your performance on the exams is much more likely to be better*. (Also, relying on others' solutions will cause me to think I can ask harder questions on the exams!)

You may use:

- Your textbook and notes from class.
- Your notes, homework, etc., from a related class that you took or are taking.
- References listed on the syllabus.
- Discussion with me.
- *Voluntary, mutual and cooperative* discussion with other students currently taking the class. This does not mean copying from each other.

You may not use:

- Solutions manuals (printed or electronic) other than what is provided with the required texts.
- Solutions from previous classes.
- Solutions, notes, homework, etc., from students who took the class previously.
- Solutions, notes, homework, etc., from classes taught elsewhere or at another time.
- Copying from students in this class, including expecting them to reveal their solutions in "discussion". That is, you may work together as indicated above as long as you prepare your own solutions.

Homework is to be submitted by the end of class on its due date unless I specify otherwise. *Late homework is not acceptable*.

Exam Policy:

Your exam solutions must be your own work, using only resources I explicitly allow, consistent with the university rules on **academic integrity**.

No exam may be taken early or made up, except if you provide a university excused absence with appropriate documentation.

Each exam will be comprehensive and cumulative.

- Please bring your own paper (blank on both sides). I ask that separate problems be on separate sheets.
- Bring resources (such as formula sheets) only if I explicitly allow them.
- You may use a calculator for numerical calculations only. The calculator *may not be part of, associated with or connected to any communication device*, such as a cell phone, iPod, tablet or laptop.

I will not expect you to quote theorems and results explicitly but I do expect you to demonstrate that you can make correct use of them. Specifically, you will need to:

- Show all your work. This does not necessarily mean showing every individual algebraic or calculus step – but it must be clear what those steps would be.
- Identify (by number, name or description) any theorems, examples or homework problems you use.
- Verify conditions and assumptions as needed for those theorems and examples.
- Clearly identify the solution and/or the end of a proof or derivation.

Selected problems from some old exams will be available on the course web page. However, their content may not exactly match this semester's exams.

Classroom:

Please turn off all communication devices (cell phones, iPods, etc.) while in the classroom. You can have a calculator for in-class work. A laptop or tablet is ok as long as you only use it to take notes or to view notes and handouts for this course. Questions are encouraged, especially to help clarify points in the lectures and homework. No question is "bad" or "dumb" if it is relevant (although I do appreciate it if you listen and avoid asking a question just answered).

Course Policies (cont.)

Makeup Policy:

This is based on university policy.

- If you must miss an exam due to illness or other university **excused absence**, notify me or the **Statistics Department** (before, if feasible, otherwise within two working days after you return). Contact me as soon as possible to schedule a make-up exam.
- An **Incomplete** will be given only in the event you have completed most of the course but circumstances beyond your control cause prolonged absence from class and the work cannot be made up.

Course Outline

1. Basic Probability

- 1-1. Introduction
- 1-2. Sample Space and Probability Measure
- 1-3. Counting Methods
- 1-4. Conditional Probability and Independence
- 1-5. Infinite Sequences of Events

2. Random Variables and Distributions

- 2-1. Definitions
- 2-2. Discrete Distributions
- 2-3. Continuous Distributions
- 2-4. Parametric Families
- 2-5. Functions of Random Variables
- 2-6. Other Distribution Types

3. Random Vectors and Joint Distributions

- 3-1. Definitions
- 3-2. Discrete Bivariate Distributions
- 3-3. Continuous Bivariate Distributions
- 3-4. Independent Random Variables
- 3-5. Conditional Distributions
- 3-6. Multivariate Distributions
- 3-7. Functions of Random Vectors
- 3-8. Mixtures

4. Expectation and Variance

- 4-1. Expectation
- 4-2. Moments and Variance
- 4-3. Inequalities
- 4-4. Covariance and Correlation
- 4-5. Conditional Expectation and Conditional Variance
- 4-6. Moment Generating Functions

5. Probability Limit Theorems

- 5-1. Infinite Sequences of Random Variables
- 5-2. Law of Large Numbers
- 5-3. Central Limit Theorem
- 5-4. Approximation Theorems
- 5-5. Multivariate Central Limit Theorem