Math 102: Elements of Statistics

Course Syllabus

General Info:

Professor	Matt Kretchmar
Office	207 Olin
Office Hours	Mon 2:30-3:30, Wed 12:30-1:30, Thr 10:00-11:00, Fri 12:30-1:20, 2:30-4:00
Email	kretchmar@denison.edu
Resource Page	`www.denison.edu/~kretchmar/m102`
Textbook	*Introduction to Statistics & Data Analysis, 5th Ed.* by Peck, Olsen and Devore. This is an e-book, see below.

Course Description:

Denison's mission statement asks our students to become autonomous thinkers, discerning moral agents and active citizens of a democratic society. The *language* of a democratic society is increasingly one of data and its analysis. An introductory course in statistics is one of the most important, impactful and relevant courses for a liberally educated student of the 21st Century. To discern emerging trends, to convince people of your point of view, to treat people with equity, to distinguish good political positions from flimsy ones all require you to be able to understand the arguments of statistics and to be able to apply them in your own life.

This course is fundamentally about the interpretation and analysis of data. We will examine collections of numbers and draw inferences about what those numbers say for the world in which we live. But we will be grounded and methodical about our inferences. Instead of merely looking for intuitive trends and conclusions, we want to be sure our analysis is grounded in provable theory – that is the fundamental distinction between someone who is knowledgable about statistics and someone who is not.

This course is simultaneously about big important ideas and also small equally important details. It is not enough to merely memorize equations or word problems (details) because the bigger ideas inform *how* and *where* to apply those equations. Without a firm grasp of the fundamental ideas, you would most likely be using the wrong tool or technique for the job and therefore forming erroneous conclusions about your data. Similarly it is not sufficient to know only the big ideas. While the fundamental concepts are important, the details allow us to actually use those important ideas to do good work. The big ideas and the important details always go hand in hand. If you can see how they relate, then you will find they support

each other – learning the both parts as a whole is much easier than learning both parts separately.

Writing

This course satisfies the *Writing Seminar* (W-overlay) requirement for Denison's writing program. Importantly, writing is centrally woven into the learning outcomes for this course rather than existing as an add-on for creating extra work. One of the most important aspects of learning to use data analysis tools is the ability to express our conclusions to a diverse set of audiences. We will develop and practice skills in forming arguments and using our statistical reasoning in effective and ethical ways. Writing-to-learn also plays a central role in this class. We will move away from the think-then-write model to integrate the writing experiences into the learning experiences.

Our TextBook

This course uses a e-book (electronic textbook) which is about half the cost of a print textbook. At the Denison Bookstore, you can buy a key which will allow you to access the class textbook and online resources. Most of the homework assignments are done online through our course textbook website, thus you will not be able to complete the assignments without purchasing access to the e-book. I recommend that you bring a laptop or tablet to class so that you can access the book during our in-class activities.

When you purchase the text key, you will go to the following website:
`https://www.webassign.net`.
At the top of this page is a button that says *Enter Class Key*. You will click here and enter the following:

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denison 4169 0689
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You will then be asked to create a web assign account (or choose one you already created).

Our text is quite large – almost 1000 pages of reading for the semester. However, it is not dense. That is, there are not as many difficult concepts per page as you would find in a normal mathematics text. Our book features a lot of diagrams, pictures and other visual depictions of the concepts. It also has many many sample problems to illustrate the key concepts.

Mathematically, the material in statistics is quite elementary; it is almost entirely addition, subtraction, multiplication and subtraction. There is no calculus,

little if any algebra, no trig, not really any proofs. This class is not difficult for its mathematical sophistication. It is, however, accumulative. So it is important to learn each concept well before moving on. If you do not have a firm foundation of the current concepts, then your tower of knowledge will ”topple” after you try to add another layer or two.

Some students do not like to read an e-book. Other students desire to keep a permanent copy of the book (the e-book expires at the end of the term). You may also purchase a hard copy of the textbook, but you will definitely need the e-book access so you can do online homeworks. If you buy a hardcopy to go along with the e-book, you can probably get by with the 4th edition. I’ve seen used copies of the 4th edition for less than $9 online.

Units

The course is designed around five different units, each of which introduces a key statistical concept.

Unit	**Text Chapters**	**Weeks**
Experimental Design and Describing Data	2-5	1-3
Probability and Distributions	6,7	4-5
Sampling and Estimation	8,9	6-8
Hypotheses	10,11	9-11
Comparing Populations	12,13	12-14

Each unit will take 2 or 3 weeks of our class time. Here is the anticipated major dates for the course:

Date	Activity
Jan 25	Paper 1
Jan 25	MLK Day (no class)
Feb 3	Paper 2, Polished Draft
Feb 10	Paper 2, Final Draft
Feb 17	Paper 3, Polished Draft
Feb 19	Midterm Exam 1
Feb 24	Paper 3, Final Draft
Mar 9	Paper 4
Mar 11	Midterm Exam 2
Mar 14-18	Spring Break
Apr 8	Paper 5
Apr 27	Midterm Exam 3
Apr 29	Paper 6
May 7	Final Exam, 2pm to 4pm

I will give you specific schedules for each unit separately and we will also keep an online calendar on the class webpage.

Grades:

Item	Number	Percentage
Written Projects	6	50%
Midterm Exams	3	30%
Final Exam	1	10%
Homeworks	14	10%
Quizzes	9	0%
Total		100%

Written Projects:
Each unit will feature a written project as the main vehicle for deeper learning and assessment. The writing projects are modeled on real-life instances where you need to apply statistical tools to solve a problem and then communicate that problem to a specific audience. We will use class time to discus the merits of good written communication, for peer-review workshops, and for drafting/pre-writing activities.

Homeworks:
Homeworks are traditionally assigned using the online *webassign* tool. This gives you immediate feedback on the accuracy of your answers. Homework is designed in this course to be a reinforcement tool, allowing you to assess and adapt your grasp of the fundamental concepts. Think of homework as free "learning" points you can earn rather than a graded assessment tool.

Quizzes:
Quizzes are designed to be short, small, self-assessment tools. They are designed to give you regular feedback about your textbook readings, your review of class notes and to prepare you for midterm exams.

Midterm Exams:
The three midterm exams are traditional tests designed to assess the important mathematical concepts. We will have three exams: after Units 1 and 2, after Unit 3, and after Units 4 and 5.

Final Exam:
There is a comprehensive final exam on Saturday, May 7, 2:00pm to 4:00pm. Do not schedule a ride home before this date; it is not possible to offer the exam at a different time/date. You will receive a 0 on the final if you are not present.

Policies:

Your physical and mental participation is required. You are expected to attend class, come well prepared, participate in discussions and engage your fellow students. If you miss class it is your responsibility to cover the material or activity that you missed. You are permitted 4 absences during the semester (excused and unexcused); each absence after 4 lowers your course grade by 3%.

Academic integrity is of the utmost importance. In this course, most of the work will be individual while a few assignments will be based on group work. You should assume that work is to be done individually unless group work is explicitly mentioned. A good rule to follow is to make sure the work you submit reflects your own intellectual achievements and not those of someone else. Cases of academic fraud are reported to the institution (where they may affect your permanent record) and will incur a course grade penalty such as failure for the assignment or failure for the whole course. If you have any doubts or gray areas, please first ask the professor.

Any student who feels he or she may need an accommodation based on the impact of a disability should contact the instructor privately as soon as possible to discuss his or her specific needs. The instructor relies on the Academic Support & Enrichment Center in 104 Doane to verify the need for reasonable accommodations based on documentation on file in that office.

The materials distributed in this class and available on the course webpage, including the syllabus, exams, handouts, study aids, and in-class presentations, may be protected by copyright and are provided solely for the educational use of students enrolled in this course. Please discuss any redistribution of course materials with your instructor. Do not post course materials or your notes from lectures and discussion on commercial websites without prior permission from the instructor. Unauthorized uses of course materials may be considered academic misconduct.

A Guideline to Course Success

Students are often apprehensive about taking a math class, especially if they have not had a math class recently or have had a prior bad experience in a math class. This class is an introductory course that is designed to be accessible to *any* Denison student, regardless of mathematical background. I offer the following suggestions as a "road map" for achieving success in this class – success should not be a secret nor should it be dependent upon mathematical ability. If you follow these guidelines, you should be able to earn an A or B in this class without difficulty, and more importantly, learn some valuable concepts that will serve you well throughout your professional life.

- **Take the Time**. As we stated before, the mathematics in this class are easy. The key challenge for this class (as with most Denison classes) is time management. You will need to invest time outside of class (about 8 hours per week or more) in order to be successful. If you cannot make this time commitment, it will be hard for you to be successful.

- **Do the Reading**. We cover nearly 1000 pages of material in the book over the course of the semester. We will **not** use class lecture time to cover the concepts in the book. Class lecture time will be used to supplement the material in the book and to review a few of the more subtle and sophisticated concepts. If you expect class lectures to allow you to learn the material in lieu of reading, you will not have an opportunity to learn. You must do the assigned reading on the dates it is assigned to be successful. If you do not, you will not learn the material, you will not know the important concepts, and you will not be successful on quizzes and exams.

- **Quiz = Free Feedback**. Quizzes are designed to offer you feedback on your learning. Quiz questions are generally similar to exam questions and stress the most basic and fundamental aspects of the course. If you are doing well on quiz questions, you should feel confident heading into an exam. Conversely if you are not doing well on quizzes, please seek additional help from the course professor and/or obtain a course tutor.

- **Homework = Free Reinforcement**. We use homework questions assigned on webassign. These are not difficult but will take some time. There is no reason you should not earn 100% on the homework questions (you are allowed to go back to fix mistakes). Think of homeworks as a study opportunity that earns you a free 10% of your course grade – this is like a big "curve" for the exams.

- **Quality Written Projects**. Each unit features a written project worth 10% of your course grade (a total of 50%). Spend time doing a quality job on these projects; resist the temptation to whip them out the night before. Your project will be graded somewhat strictly on quality of product. This means you should demonstrate good mathematical content related to the particular unit, but you should also have a well-written paper free of typos, grammatical errors, and other mechanical mistakes. Spend time making quality graphics for your reports. Think about your audience and their needs. Consider the organization of your report.

  These projects are an important aspect of this course in that it is the primary opportunity for you to transfer the content to practical real-world applications. Think of the writing projects as exercises to deepen your understanding of the material, as a complimentary learning experience. Because they are important, they are worth half of your overall course grade.

- **Practice for Exams**. Exams make up 40% of your course grade. They are your opportunity to demonstrate that you know the key concepts. You will be allowed to bring a one-page "cheat sheet" of your own hand-written notes to each exam. To do well on the exams, don't just review problems – actually practice solving problems without looking at the answer. Many exam problems will come from our quizzes, homeworks and our in-class exercises. Practice doing these same problems over and over again to be sure you know them well.

- **Attend Class**. Come to every single class. In addition to a few clarifying lectures, we will spend lots of in-class time doing example problems, both individually and in small group settings.

- **Use Office Hours**. If you are stuck, come see me outside of class. Don't wait until you've had a bad exam experience. I love working with students outside of class and am happy to be here as a resource to help you learn the material.