

BIEB 100: Biostatistics Lecture & Lab

Course Information (updated 23 September 2015)

Fall Quarter 2015

Lecture: MWF 3:00-3:50PM York 2622

Be sure to check TED for any updates.

Lab A01: Monday	5:00-5:50PM, ERCA 117
Lab A02: Monday	6:00-6:50PM, ERCA 117
Lab A03: Tuesday	2:00-2:50PM, ERCA 117
Lab A04: Tuesday	3:00-3:50PM, ERCA 117
Lab A05: Wednesday	10:00-10:50AM, ERCA 117
Lab A06: Wednesday	11:00-11:50PM, ERCA 117

Please note: information in this syllabus is subject to change. Any schedule changes will be announced in class and posted on TED. Make sure to frequently check TED to keep updated about the readings, assignments, and exam schedule.

Philosophy

Educational research has shown that academic success in a course depends on a student investing time and effort in learning and actively participating in a course. Learning involves wrestling with new concepts, practicing new techniques, and rethinking old assumptions. My role as the professor and the role of your Instructional Assistants is to facilitate your learning by providing targeted materials for you to use, structuring your exposure to a logical sequence of topics, clarifying misconceptions, helping you work through difficult material, and giving your ongoing feedback about your progress. You should see this course as a collaboration – between you and your instructors and between you and your fellow students as we collectively work through the material. How much you get out of the course and how well you do in it will depend upon how much you engage with the material and how much discipline you apply towards mastering new concepts and deploying them. To that end, the assignments are designed to keep you from falling behind, to help guide you through the key learning goals for each section, and to give you your first exposure to new concepts, and the lectures are designed to clarify misconceptions and to work through examples of how statistical concepts are used and misused in real research questions and in public life.

Students often come to an introductory statistics course expecting to memorize a series of recipes and formulae to apply in well-defined situations. Statistics is not a cookbook for using formulae but rather a process for getting reliable answers to interesting questions – it embodies the scientific method. Statistical formulae are sometimes (but not always, as we will see) used in this process and make no sense without the preceding components. Moreover, the wide variety of statistical tests out there to handle disparate kinds of data are all based on a common logic. Understanding this logic transforms statistics from a hodge-podge of individual, unrelated, arcane formulae into a conceptually coherent and flexible framework for answering all kinds of questions and for thinking about the world.

Every day you are exposed to numbers and data and conclusions drawn from them (or despite them). They are rarely as clean and clear as a textbook problem and yet they form the basis for crucial public and private decisions, political and social debate, and scientific discoveries. Statistics and the scientific method is a way of evaluating these numbers and drawing conclusions from them in a reliable and justifiable way. The US Presidential election season is ramping up – how should you interpret polls, particularly when they disagree with each other? How can you evaluate the numerical claims that the candidates make? Can you really make data say anything you want? The popular press loves to report the latest in nutritional research – is red meat really bad for you? Is chocolate good? Do genes determine everything about you? How can we really know whether we are in the middle of a massive extinction event or whether climate change is caused by humans or not? What is a scientific model anyway? What do you need to know in order to properly interpret medical tests, and does your doctor know these things?

This course is designed to help you develop competence in three related areas.

The first is *statistical literacy*. This involves:

- 1) awareness of data, how they are used and misused, and the consequences of each
- 2) understanding basic statistical concepts

- 3) knowing the basics of how to collect data and summarize it
- 4) knowing how to relate statistical results back to the context of the original question
- 5) being able to communicate the results to others

The second is *statistical reasoning*. This involves:

- 1) applying statistical ideas
- 2) making sense of statistical information
- 3) interpreting graphical displays and numerical summaries
- 4) checking whether intuitive conclusions from data really hold up

The third is *statistical thinking*. This involves the following habits:

- 1) consider how to collect meaningful and relevant data to answer a particular question
- 2) keep in mind the statistical process as a whole and how the different pieces fit together
- 3) be skeptical, particularly about how data is obtained
- 4) think about the variables involved – are they the right ones for the question? how will they behave? are there other variables that might be important?
- 5) always keep the context in mind. How does the data relate back to the original question?
- 6) understand the relevance of statistics, especially when you want to make a causal claim or say something is unusual.
- 7) think beyond the textbook.

I have designed this course so that you will emerge from it with a healthy and statistically grounded skepticism about the numbers and data that pervade our society and so that you will be able to collect data and properly draw conclusions from it and evaluate conclusions that others draw from their own data. We will get to that point by carefully studying and repeatedly practicing the methodology and tools of statistical investigation. For those of you planning to go to medical or graduate school, the MCATs and the GREs are emphasizing this type of thinking more and more.

Homework structure and purpose

We will use WileyPlus, a collection of online material that includes the textbook, homework questions with hints and links to the textbook, practice questions with answers (including worked answers to all the odd-numbered questions), short explanatory videos by the authors of the textbook, and other resources. This is a rich collection of resources that will help you study efficiently and think through the material.

You will be able to access the homework assignments through TED. Most will be sets of questions from the textbook that you can complete in the TED/WileyPlus environment. A few will require other tools, and you will turn these in online through TED.

Although the homework is graded, its main purpose is to give you a structured way to stay abreast of the course material – it is a learning tool. The concepts we will learn are cumulative, and if you fall behind it can be hard to catch back up. You get 3 attempts to answer each question. WileyPlus gives you hints and guidance on the question if you get it wrong at first. After 2 wrong attempts, you can only get 80% of the points for that question, but you do get to try one more time. After 3 attempts, the software will show you how to solve the problem. So use it as a tool for self-

evaluation. If you have trouble with a question, then re-read the relevant section and/or do practice or odd-numbered questions that cover the same concept to make sure you understand.

The homework assignments from the textbook/WileyPlus are listed in the course calendar in TED and consist of around 10-15 questions and will be due *before* we cover the material in class. This might seem odd, but there is a good reason for it.

Engaging with the material before the lecture helps both you and your instructors. For you, it means that you have already wrestled with the material before you hear about it in lecture. You have already thought about it and have some familiarity and understanding of it and you have been exposed to new terminology. Many studies have shown that students who engage with the material before lecture get more out of a class than students who hear about a topic for the first time in class. This makes sense. If you have already familiarized yourself with a concept, then class can be a time when you refine your understanding of it and ask targeted questions about it instead of trying to grapple with a new idea and its nuances and applications all at once.

By turning in the homework before class, you give your instructors the chance to review your understanding of the material. Each homework assignment covers a few concepts. If the entire class gets questions about a concept correct, then covering that idea in class would be a waste of time. On the other hand, if the homework shows that many students are struggling with a particular topic, then it is worthwhile for us to spend class time working through those ideas and clarifying them.

In a traditional course you are introduced to a topic in lecture, then you complete a homework assignment on it over the next week while the lectures move to a new topic. You are juggling two sets of ideas at once. Moreover, by the time you get your homework back, you have moved on even further and don't really have a good opportunity to correct misunderstandings before exams creep up on you.

This course is organized so that the reading, homework, and lectures cover the same set of concepts at the same time. You read about them in the textbook. You practice them in the homework problems. We discuss difficult aspects of them in class either directly or through examples. Then we move on.

We will also spend time working through examples in class. Part of this will involve discussing a problem or question with other students, trying to explain a concept in your own words or arguing your case for why it is answer A and not B. Putting an idea into words and explaining it to someone else is a very effective way to determine whether you really grasp an idea. If you think you understand something but there is some aspect of it that you can't quite explain, then you have identified the weak link in your understanding. The goal of peer instruction is to expose these weak links and make them stronger.

There will also be a longer-form weekly assignment. This will consist of a guided application of the concepts covered that week to papers in the real world. In most cases, you will need to find a scientific research article in a journal, read it, and answer questions about the data and the statistics used. The goal of these assignments is get you reading the actual research literature. Learning how

to read and understand the analyses in a scientific paper is a crucial skill that a science major should have. Some of you will have already done this in other courses or if you work in labs, but if you are taking this course, then you may have glossed over the statistical methods in those papers. These assignments will help you practice reading a research article with some key questions in mind – questions like: *What are the variables?*, *How was the study designed?*, *Are the limitations due to the study design?*, *How strong is the evidence?*, *How strong is the effect?*, *Was the type of analysis appropriate?*, *Do the conclusions actually follow from the data?* These research article reports will be graded on a ✓+ / ✓ / ✓- / 0 scale.

Exams

There will be two in-class midterms and a final exam. The midterms will cover material from chapters 1-3 (first) and 4-6 (second). The final will be cumulative, reflecting the fact that the material in the course is cumulative. Exams will have a mix of questions specifically testing higher and lower order mastery of the material. The exam questions will be similar to homework questions, but there will also be at least one question that requires you to apply what you have learned in a new context. There are two midterms so that each one covers a limited amount of material. By having the first one after the 3rd week you will get feedback on how you are doing in the course early enough so that you can change your approach to the course if you need to. These exams also give you information about what specific concepts you may be struggling with. Take advantage of office hours, the discussions board, or one-on-one meetings with your instructors to work through these concepts and correct misunderstandings.

Exam dates

19 October	2015	Midterm 1 (chapters 1-3)
16 November	2015	Midterm 2 (chapters 4-6)
11 December	2015, 3-6 PM	Final exam (cumulative)

Grading

The grading breakdown for components of the course is:

Midterms	15% each
Final	33%
Weekly research article reports	15% (equally weighted across reports)
Homework	20% (each question is worth the same amount)
Pre-class and post-class tests	2% (simply for taking them before the deadlines)

The final grades will eventually be curved, but a rough grade range guideline is:

A (90-100%) B (80-90%) C (70-80%) D (60-70%) F (below 60%)

Textbook

The textbook is called *Statistics: unlocking the power of data*.

Contact Information and office hours

Professor

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When emailing your instructors, please put 'BIEB100' in the subject line so we know it is about the course. Try your instructional assistants first. Please keep in mind that it may take a little while to get back to you and that you shouldn't expect an answer after 9PM. The discussion board on TED is also a good place to ask questions. An IA will check it at least once a day, but you may also get good explanations from other students.

The office hours are a great way to get personal help with any questions you have on the course material.

Software

Software comes in handy for doing statistical calculations and simulations. We will make extensive use of a set of web applets which are integrated with the textbook *but also can be used for your research or other classes*. Let me emphasize this again: although these are web applets, their results are perfectly valid and you can use them to analyze data outside this class. The applets can be found at: <http://lock5stat.com/statkey/>. We may occasionally use other applets, and there will be links to these on TED.

If, after this class, you find yourself using statistics frequently to analyze data, I would highly recommend you learn R. R is both a programming language and the most widely used statistical software in the world. There are tons of online and paper resources for learning R. You can find some very good ones by searching "tryR code school", "datacamp R", "rstudio online learning", or "swirl learn R."

Cheating

Students are expected to do their own work, as outlined in the [UCSD Policy on Academic Integrity](#). Cheating will not be tolerated, and any student caught engaging in academic dishonesty will fail the course. He or she may also be suspended from UCSD. All exams will be closed-book and closed-notes, so all personal materials must be stowed under your seat. Only exams written in non-erasable pen will be considered for regrades. There will be assigned seats in the exams, and you will receive your seat assignment before the exam.

Computers and phones in class and sections

Computers, phones, and other distraction-enabled devices require care and consideration when used in class. There will be instances where we use applets to explore a topic together in class, and laptops or tablets will be handy in those circumstances. These occasions will be announced in advance. However, laptops are not a good tool for taking notes in this class. They do not have the versatility necessary for capturing text, sketches, arrows, etc. that are important for note-taking in statistics. Bring paper and something to write with to take notes in class. If you have a stylus to write on a tablet, then you may use that, although only for note-taking. We will use computers for some exercises in sections, but you are expected to be courteous to your fellow students and TA and use them only for the intended purposes. Students using computers for purposes other than those related to the class will be asked to leave. Phones are only to be used for emergencies and outside the classrooms.

Podcasts

The course will be video podcast. You can download video podcasts from: <http://podcasts.ucsd.edu/>. However, be aware that the video portion only captures what is projected onto the screen from a computer. Since the chalkboards will be used heavily in lectures, the video portion of the podcast will be of limited use. You can also find an audio podcast link at that site.

Feedback

Learning is a collaborative endeavor and so your feedback is crucial. This is part of the motivation for having the homework due before class – so your instructional assistants and I can figure out what concepts are still confusing you. You should also feel free to post questions and ideas on the discussion board on TED.

Extra supplies needed for this class

Class demonstrations will occasionally require tools. Please go to <http://www.random.org/integers/?mode=advanced> and print out a set of 1000 random digits from 0 to 9. (For easy printing choose 15 columns in Part 1, “Bare bones text” in Part 3, and “generate your own” in Part 4). Please also use this website to print out a set of 100 random numbers from 1 to 200 and a set of 100 random numbers from 1-3. Please bring these sheets and a coin to every class. If we will need a different tool for a demonstration or for lab (e.g. dice, deck of cards, ruler, etc.) it will be posted on the website and announced in class.

Regrades

If an error has been made in the grading of your homework or exam, you may submit it to your IA (homework) or Prof. Rifkin (exam) within *one week* of distribution for a regrade. **Do not go to a IA for an exam regrade. Your exam must first be submitted to Prof. Rifkin with a written description of the grading error.** Regrade requests will not be processed without a written description of the grading error. **No regrades will be given for exams written in non-permanent ink or pencil.**

Missed exams

There are no makeup exams. However, unavoidable emergencies happen, like a serious illness of yourself or a close family member. If you unexpectedly miss a midterm, you will be required to provide official documentation. Without such documentation, you will receive a 0 for the midterm. If you know beforehand that you cannot be present in the classroom for a midterm and (1) can present a valid excuse (such as a note from your coach for a sporting event) at least one week in advance of the exam and (2) are receiving a passing grade in the course as of one week before the exam, then a sealed copy of the exam will be given to the coach, musical director, etc. who will administer the exam **at the class exam time**. If no UCSD official can be found to administer the exam or if the exam cannot be taken at the class exam time, then it will count as a missed exam. If you miss the midterm with a valid excuse (unavoidable emergency or a pre-arranged absence as per above) the other midterm and the final will each count 7.5% more.

The final exam is on Friday, 11 December from 3-6PM. There is no alternative final.