

INTRODUCTION TO BIOSTATISTICS
Spring 2013

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Goal: The goal of this course is to help you develop statistical reasoning skill, which should make you a more effective scientific investigator.

Text and Software:

The text is *Statistics for the Life Sciences, 4th ed.*, by Samuels, Witmer, and Schaffner. For software we will use the statistical package R, specifically the implementation RStudio. (Regular R is also available, for free, at <http://www.r-project.org/>)

Course Outline:

We will cover essentially all of *Statistics for the Life Sciences*. I hope to cover chapters 1-5 (EDA, probability, the normal distribution, sampling distributions) by the time of the first exam (see below), and chapters 6-9 (confidence intervals, two-sample tests, paired data, categorical data) for exam 2. The final will be comprehensive (including two-way tables, analysis of variance, and linear regression).

Note that this is a statistics course. We will use mathematics as a tool, but will concentrate on statistical ideas, not on mathematics. Most of you will find the mathematics in this course to be rather easy. However, most people -- including people who have been using statistical methods for many years -- find the key concepts in statistics to be quite hard to really understand. It is easy to get a surface understanding of statistics. It is even easier, with a computer, to "do" statistics. It is hard to really understand what you are doing. Class time -- and exam questions -- will be devoted to the understanding part.

Part of what is hard about statistics is that context matters and interpretation matters. Being able to explain what the data say (and what they don't say) is important and can be quite difficult. So here is some advice: You will need to learn a bit about how things are calculated in statistics, but this is relatively easy. Spend most of your time and effort trying to understand what things mean, how they are interpreted, and how to talk about them.

"Context" is a word that will show up at many times during the semester. When I say "explain in context" I mean "If the problem is about blood pressure, then talk about blood pressure. If it is about age, then in your answer talk about age." Giving a response to an exam question that is perfectly correct mathematically but that does not provide context will result in you being unhappy (when I take off points for lack of context).

"Significant" is another word that will show up at many times during the semester but in two different meanings: "statistically significant" and "practically significant". I will try to always use one of the two modifiers whenever I use the word significant; you should as well. Failure to distinguish between "statistically significant" and "practically significant" is one of the scientific world's larger problems, so let's help each other not perpetuate this problem.

"Mean" is a word that will show up at many times during the semester, sometimes in reference to a sample and sometimes in reference to a population. Usually it will be clear whether "mean" means "sample mean" or "population mean" but not always. I will try to always use one of the two modifiers whenever I use the word mean. You should as well, *especially on exams*.

Office Hours: 10-11 MTWF, 3:30-4:30 MWF

Note: During office hours I will almost certainly be in or near my office. I am usually in my office between 9 and 5:30, except when I am in class or at a meeting; *you should feel free to drop in and see me at any time.* You only need an appointment if you want to guarantee that I will be in at a time other than an office hour.

Bb:

Course information is available on Blackboard. I'll post homework sets and announcements here as well as daily quizzes.

Homework:

Some of the homework problems at the end of each section and chapter have solutions in the back of the book. Problems will be assigned from these exercise sets on a daily basis. These will not be collected, but they are good practice for the exams and you should do them. Some homework will be assigned, collected, and graded from those problems for which solutions are not given in the back of the book. I'll make solutions available for the "hand in" problems after they are due. All homework is due on the announced date at the beginning of class. Late work is not accepted. A list of homework problems is given at the end of this syllabus.

Labs:

There is a weekly lab session that most weeks will use the computer and be held in King 137. For the most part, the labs will accompany material presented in lecture, but sometimes new material will be introduced in lab. We will use the computer package R extensively in the labs. I will use Blackboard as a means of making data available to you. Each Friday (except for week 1) you will be expected to hand in a completed lab exercise sheet, as evidence that you have done the work and have answered the appropriate questions. These lab sheets will be graded and, taken together over the semester, will count for 80 points.

Quizzes:

There will be short quizzes on the daily reading assignment that are to be completed on Blackboard prior to 8:30 a.m. on most class meeting days. These are simple checks that you have done the daily reading and know the basic definitions. The quizzes will count for about 70 points.

Exams/Projects /Grades:

We will have two midterm exams and a comprehensive final. You will also complete a project in which you collect and analyze data of your choice. The project report is due near the end of the semester; I'll provide more information about this later. The exams are worth 100 points each. You may bring a 3x5 card with notes hand-written on one side to each exam. The final is worth 150 points and is open-book. The quizzes are worth about 70 points (total). The labs are worth 80 points (total), as is the homework. The project is worth 100 points. I'll drop the lowest lab report score, the lowest homework score, and the *two* lowest quiz scores from your grade. Course grades are based on total points earned.

Honor System:

The Honor System applies to all graded work. You may work with others on homework and in the labs, but you must submit your own work. For the project you may work with a team and submit one report as a group. Of course, on exams and quizzes you will work alone.

Calculators:

You will want to have a calculator for exams, but you don't really need anything fancy like built-in statistical features. Some calculators have extensive statistics capabilities -- which are very useful -- but you don't need such a calculator for this course.

Exam Schedule:

Exam 1	Friday, 8 March (tentative)
Exam 2	Wednesday, 17 April (tentative)
Final	Thursday, 16 May, 9:00 a.m. (definite)

Homework list

These dates are subject to change, so take a look at the course Bb page from time to time (but I expect to be able to stick to this schedule). Note that "2.3" means "exercise X.2.3 in Chpt X."

Chapter 1 do: 2.3, 2.7

hand in: 2.6, 2.8; 3.2

due Monday 2/11

- Chapter 2 do: 1.2; 2.1; 3.5, 3.13, 3.14; 4.2; 6.4, 6.14, 6.15
hand in: **1.4; 2.8; 3.7, 3.15; 4.5; 6.16; 7.2; S.7, S.17** due Monday 2/18
- Chapter 3 do: 2.1, 2.5; 4.3; 5.1; 6.6, 6.9; S.7, S.10
hand in: **2.3, 2.7; 4.1; 5.2; 6.1; S.9** due Friday 2/22
- Chapter 4 do: 3.3, 3.4, 3.8, 3.12; 4.2, 4.8; S.6, S.14
hand in: **3.9, 3.10, 3.11, 3.15** due Friday 3/1
- Chapter 5 do: 1.2; 2.5, 2.10, 2.13; 4.4
hand in: **1.3; 2.8, 2.19; 4.5, 4.11; S.8** due Monday 3/4
- Chapter 6 do: 2.1, 2.7; 3.3, 3.4, 3.10, 3.14; 4.2; 5.1, 5.6; 6.1, 6.7; 7.1, 7.6; S.2, S.9
hand in: **2.2, 2.6; 3.6, 3.12; 4.3; 5.7; 6.4; 7.2, 7.8; S.8, S.10** due Friday 3/15
- Chapter 7 do: 1.2; 2.1, 2.3, 2.7; 3.4, 3.6; 4.1, 4.9
hand in: **1.1; 2.8, 2.10, 2.15; 3.7; 4.2** due Monday 3/18
- Chapter 7 do: 5.1, 5.3, 5.10; 6.6, 6.7; 7.1; 8.1; 9.1; 10.1, 10.3; S.8
hand in: **5.5, 5.6; 6.8; 7.8; 10.4; S.21** due Friday 3/22
- Chapter 8 do: 2.3, 2.6, 2.11; 4.1, 4.4; S.8
hand in: **2.4, 2.5; 4.5, 4.9; S.6, S.7** due Friday 4/5
- Chapter 9 do: 1.1, 1.2, 1.4, 1.5; 2.2, 2.5, 2.7; 3.4; 4.1, 4.2, 4.8; S.12
hand in: **1.7, 1.10; 2.1, 2.6, 2.12; 3.2; 4.3, 4.11** due Friday 4/12
- Chapter 10 do: 4.1; 2.3, 2.5, 2.14; 3.3, 3.4; 5.3; 6.2; 7.3; 8.1; 9.1, 9.7
hand in: **4.2; 2.4, 2.6, 2.9; 3.10; 5.2; 7.2; 8.3; 9.4** due Friday 4/19
- Chapter 11 do: 2.1, 2.4; 4.2; 6.2, 6.5; 7.2; 8.2, 8.7; 9.1, 9.2
hand in: **2.5; 4.1, 4.5; 6.1, 6.4, 6.9; 7.6; 8.9; 9.3** due Monday 4/29
- Chapter 12 do: 2.3, 2.5; 3.1, 3.2, 3.5; 4.5; 5.1, 5.5, 5.7; 6.6
hand in: **2.4; 3.4, 3.8a,b,e; 4.1, 4.2; 5.4; 6.3, 6.7** due Wednesday 5/8
- Chapter 13 do: 2.1, 2.7, 2.10, 2.12, 2.13, 2.15
hand in: **nothing**

