BI311 Syllabus

updated: 18 August 2014

Meeting times:

Section 1: 10:30 - 11:20 AM, Mon, Wed, Fri → Henry Lab 2
Section 2: 10:00 - 11:20 AM, Tues, Thurs → Henry Lab 1

Instructor: Associate Professor Michael Dohm
Office: Henry Hall 6
Office Hours Monday & Friday, 12-2PM; By appointment
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Course Description

Biostatistics is a lecture plus hands-on course designed to provide students with the opportunity to develop analytical and statistical reasoning skills appropriate for biology. It is the first in a series of two courses in biostatistics and epidemiology (BI 312) at Chaminade. Statistical reasoning may be defined as the ability to understand and use probability arguments and to recognize the distinction between specific and generalized conclusions. After an introduction to data sets and the three philosophical positions of statistical hypotheses (frequentist, likelihood, and Bayesian), students will learn to apply statistical reasoning to questions about biological processes. During the semester, students will be given an introduction to (1) statistical tools and approaches used in biological and biomedical research, and (2) experimental design and analysis. Students will learn about error concepts and to identify and estimate via experimental design or simulation impacts of experimental versus biological sources of error on conclusions. Students will move from descriptive statistics and issues of parameter estimation to factorial experimental design (ANOVA, contingency tables), and general linear and logit models, all with examples and problem sets from biology.

Learning Outcomes

Students will

1. Demonstrate statistical results and data presentation through appropriate use of summary tables, graphics, and written summary sentences.
2. Identify and distinguish among data types, variables, and parameters from published research.
3. Choose, defend, and contrast among kinds of statistical tests given data sets and description of an experiment.
4. Describe the difference between description, hypothesis testing, and prediction in statistics.
5. Interpret and evaluate results of statistical inference and justify statistical choices.
6. Recognize and identify output from statistical software.

Statistical reasoning

Statistical reasoning may be defined as the ability to understand and use numbers to communicate findings and to support opinions. Statistical reasoning is important to your future, for two reasons. The

biological sciences are, by their nature, an experimental science: all disciplines in biology involve the presentation and analysis of data. Consider a biomedical example: You work as an AIDS counselor in a major U.S. city. Before you is the result of a male client's HIV test. It is positive, meaning the ELISA and Western Blot tests detected HIV in the blood sample. The client, who insists that he does not fit any known risk behavior group, now sits before you, waiting to hear the results. Your training has given you the following facts: (1) less than 0.01% of men fitting this category (heterosexual, no IV drug use) are infected with HIV in the U.S.; (2) the sensitivity of the tests is very high, 99.9% (sensitivity is defined as the percentage of individuals with a disease who are correctly classified by a test as having the disease); and the specificity of the tests is also high, 99.9% (specificity is defined as the percentage of individuals without a disease who are correctly classified by a test as not having the disease).

How do you communicate the client's test results?

Statistical reasoning is common to our daily lives. The above example illustrates the problem from the perspective of a counselor, but as citizens, we are faced with a barrage of numbers: our risk of developing a particular disease (breast cancer, 1 in 9 women; prostate cancer, 1 in 9 men, etc.); our risk from dying under general anesthesia (on average, about 0.01% or 1 death every 10,000 U.S. cases); our risk of dying in a car crash versus our risk of dying in a plane crash. Data summaries, projections and predictions, and declarations of probability and likelihood are important tools for communicating complex information. The media commonly employ these tools to present information to you: The latest results from clinical trials of an HIV drug therapy, putative links between diet and health, effects of environmental toxins on health... the list is long.

Often, the portrayal of medical and health news in the media is conflicting, and the lack of consistency can be explained in part by failure to communicate the statistical issues. One result from the media's poor presentation of science results is the impression that just about everything and anything can be shown to adversely affect health... not a very useful conclusion. More importantly, exaggerated claims are made with numbers, and it may be difficult to sort fact from interpretation from fiction when numbers are used.

Required Text(s)

1. Mike's Biostatistics book. Available as ebook and from course web site.
2. Mike's statistics workbook, provided in class and via course web site.

Other text books (recommended but not required)

Books on R

1. Knell, R. 2013. *Introductory R: A Beginner's Guide to Data Visualisation and Analysis Using R* [Kindle Edition]. Link to Amazon.com. At less than $6, this is a really good, short book to answer many of your questions about R.
2. Everitt, B. S., and T. Hothorn. 2009. *A Handbook of Statistical Analysis Using R*, 2nd edition. Chapman and Hall/CRC. (ISBN 978-1420079333). Link to Amazon.com. This book is a reference to using R.

Other (bio)statistics textbooks

1. Glover, T., and K. Mitchell. 2008. *An Introduction to Biostatistics*, 2nd edition. Waveland Press. We used this book previously.
2. Norman, G. R, and D. L. Streiner. *Biostatistics: The Bare Essentials*. People's Medical Publishing House. We used this book previously; any edition would be suitable.
3. Whitlock, M. C., and D. Schluter. 2008. *The Analysis of Biological Data*. Roberts and Company. We used this book previously.

Lectures and workbook

Slides presented during class time are posted on the course website for your use. derived from my Moodle site for the course. Homeworks, quizzes and related materials are also made available on the site. Access to the site is via http://www.letgen.org/chaminade

Assignments

Homework: There will be up to twelve (12) worksheets that will help you understand concepts that we cover in class. The homework will not be graded, but these weekly assignments include analyzing data relevant to lecture topics and to analysis necessary for graded reports. Homework will include, but are not limited to the following kinds of tasks: calculations and formula derivations, presenting experimental designs, methods and statistical results using tables and graphs. Homework may also include online multiple choice problems via the Moodle site. Some work will be done in class time, but most of the work will need to be completed outside of class time. You may work together on homework, but each student must turn in their own homework.

Work on your own: Your textbook also has many nice problems to work on: I will recommend many, but will not grade work from the text book. While these are not required, the more you do, the more you will benefit. You can expect a learning curve with biostatistics -- it is imperative that you make the effort on your own, outside of class, to do as much applied work as you can. We will discuss some of these problems in class as part of lecture.

Quizzes: Ten (10) weekly quizzes will be assigned; these multiple choice questions are designed to test your knowledge and provide instant feed-back.

Reports: You will also develop four research reports based on extended data sets that we will develop during class. Reports will be in the form of a science paper and are worth 15 points each. Additional details about the report and project will be given at appropriate times in the semester.
Exams

Four exams:

- Exam 1 will cover material from weeks 1-4.
- Exam 2 will cover material from weeks 5-8.
- Exam 3 will cover material from weeks 9-12
- Exam 4 will cover material from weeks 13-15

The exams will focus on your understanding of important concepts, your ability to evaluate

experimental designs, and your ability to recognize appropriate statistics to be employed given sets of data or particular experimental designs. Exam questions will be drawn from homework and/or from suggested problems in the textbook.

Class Participation: You are expected to come to class prepared, to participate fully in class by asking questions, bringing attention to media announcements of relevance to biostatistics, by helping in data collection needed for homework projects. I also encourage all of you to assist fellow students with computer and statistical software-related questions.

Grading

Item	How many?	How often may I expect this item?	How many points is each item worth?	Total points towards your final BI311 grade
Homework	12	weekly	0	0
Quizzes	10	weekly	4	40
Reports	4	1 or 2 per month	15	60
Exams	3	every 4 to 5 weeks	100	400
Total				500

How your final grade is determined♠

Points earned	Percent (%) of total	Letter grade
540 - 600	90-100%	A
480 - 539	80 - 89%	B
420 - 479	70 - 79%	C
360 - 419	60 - 69%	D
≤ 359	< 60%	F

Policy reminders and notices

1. This computer classroom was designed and is now maintained by Chaminade's Department of Information Technology and the Division of Natural Sciences and Mathematics so that you would have access to a state-of-the art academic computing environment. Money is simply not available to repair abused or stolen computers. Therefore, each person has the responsibility to use the computers responsibly. By using these facilities, you agree to abide by the Computer Room Policies posted in the classroom. These rules include, but are not limited to *No food or drink *You agree to adhere to the account setup procedures and use restrictions *No alterations of software or hardware configurations *No use of the computers for personal or commercial activities, (except where such activities are otherwise permitted or authorized under applicable University policies).
2. Class begins and ends each time exactly on the scheduled start time. Regular attendance is expected and essential for your progress in this class. The goal of lecture and discussion will be to provide the needed context to remove barriers to your understanding of the material. We will be using a statistics software package (R) that will be intimidating at first -- going it alone is not recommended.

3. Use of music devices and cell phones is prohibited during all Natural Science and Mathematics classes at Chaminade, unless specifically permitted by your instructor. Use of cellphones and music devices in laboratories is a safety issue. In addition, use of cellphones and music devices in any class is discourteous and may lead to suspicion of academic misconduct. Students who cannot comply with this rule will be asked to leave class and may be subject to laboratory safety violation fines. Please refer any questions to the Dean of Natural Sciences and Mathematics.
4. You are encouraged to bring and use your laptops and tablets to Biostatistics lecture and workshops. Calculators will be provided for your use on Exam days.
5. Please utilize my official office hours or make an appointment via the Moodle site if you wish to discuss biostatistics.
6. No make up quiz, exam, or presentation time will be granted for unexcused absences. For excused absences, if a student cannot attend a class in which a quiz has been scheduled, the student must provide written verification of the need to miss class at least one day prior to the scheduled due date. This includes any activities sponsored by Chaminade (athletics, etc.) -- it is the responsibility of the student to adhere to this policy. In the event of illness, a Doctor's note will be expected.
7. You are encouraged to work together; however, all graded material must be your own. You are also expected to have read and to abide by the "Student Rules of Conduct" which are available in your copy of Chaminade University's Student Handbook.
8. Students with special needs who meet criteria for the Americans with Disabilities Act (ADA) provisions must provide written documentation of the need for accommodations from the CUH Counseling Center (Dr. June Yasuhara; phone 735-4845) by the end of week three of the class, in order for the instructor to plan accordingly. Failure to provide written documentation will prevent your instructor from making the necessary accommodations. Please refer any questions to the Dean of Students and review the procedures at http://www.chaminade.edu/student_life/sss/counseling_services.php.

BI311 Lecture schedule

All attempts to plan the course accurately have been made. However, the instructor reserves the right to change dates of lecture topics and due dates of some assignments. Reasons for possible schedule changes include progress we make through topics or if instructor must miss class.

Week	Date	Text readings	Assignments
1	Mon, Aug 25	Chapter02	
	Tue, Aug 26	Chapter03	
	Wed, Aug 27		
	Thu, Aug 28		
	Fri, Aug 29		Homework01
2	9/01 No class	Chapter04	
	Tue, Sep 2	Chapter05	Quiz01
	Wed, Sep 3		
	Thu, Sep 4		
	Fri, Sep 5		Homework02
3	Mon, Sep 8	Chapter06	
	Tue, Sep 9	Chapter07	Quiz02
	Wed, Sep 10		
	Thu, Sep 11		
	Fri, Sep 12		Homework03
4	Mon, Sep 15		
	Tue, Sep 16		Review01
	Wed, Sep 17		Review01
	Thu, Sep 18		Exam01
	Fri, Sep 19		Exam01
5	Mon, Sep 22	Chapter08	
	Tue, Sep 23	Chapter09	
	Wed, Sep 24		
	Thu, Sep 25		
	Fri, Sep 26		Homework04
6	Mon, Sep 29	Chapter10	
	Tue, Sep 30	Chapter11	Quiz03
	Wed, Oct 1		
	Thu, Oct 2		
	Fri, Oct 3		Homework05
7	Mon, Oct 6	Chapter12	
	Tue, Oct 7	Chapter13	Quiz04
	Wed, Oct 8		
	Thu, Oct 9		Homework06
	Fri, Oct 10		
8	10/13 No class		
	Tue, Oct 14		Review02

	Wed, Oct 15		Review02
	Thu, Oct 16		Exam02
	Fri, Oct 17		Exam02
9	Mon, Oct 20	Chapter14	
	Tue, Oct 21	Chapter15	
	Wed, Oct 22		
	Thu, Oct 23		
	Fri, Oct 24		Homework07
10	Mon, Oct 27	Chapter16	
	Tue, Oct 28		Quiz05
	Wed, Oct 29		
	Thu, Oct 30		
	Fri, Oct 31		Homework08
11	Mon, Nov 3	Chapter17	
	Tue, Nov 4		Quiz06
	Wed, Nov 5		
	Thu, Nov 6		Review03
	Fri, Nov 7		Homework09
12	Mon, Nov 10		Review03
	Tue, Nov 11		
	Wed, Nov 12		Exam03
	Thu, Nov 13		Exam03
	Fri, Nov 14		
13	Mon, Nov 17	Chapter18	
	Tue, Nov 18		
	Wed, Nov 19		
	Thu, Nov 20		Homework10
	Fri, Nov 21		
14	Mon, Nov 24	Chapter18	
	Tue, Nov 25		Quiz07
	Wed, Nov 26		Homework11
	Thu, Nov 27		
	Fri, Nov 28		
15	Mon, Dec 1	Chapter18	
	Tue, Dec 2		Quiz08
	Wed, Dec 3		Review04
	Thu, Dec 4		Review04
	Fri, Dec 5		

Final Exam

BI311-01 Dec 11 11AM -- 1PM
BI311-02 Dec 8 8:30AM -- 10:30AM