

Instructors	Cecile Ane (lecture 1)	Nicholas Keuler (lecture 2)
Office	1208 MSC	1217A MSC
email	ane@stat.wisc.edu	keuler@stat.wisc.edu

As much as possible, the two lectures will cover approximately the same material at the same speed. Students may attend the alternative lecture when desired. The exams, homeworks, policies and grading will be identical.

**Course website:** [www.stat.wisc.edu/courses/st571-ane/](http://www.stat.wisc.edu/courses/st571-ane/) for handouts, homework assignments and other course information.

**Course objectives:** The goal is to provide graduate students in the biological sciences with a thorough understanding of statistical methodology, so that they may apply it to their own research and answer questions like: what statistical test should I use? How can I check that the test is appropriate? How do I interpret the results? Mathematical complexity will be kept to a minimum, while applications will be used to illustrate the concepts.

**Textbook.** Two texts are indicated below. Either one is sufficient. Getting one of these two is recommended.

1. *The analysis of biological data* by Michael Whitlock and Dolph Schluter.
2. *Course notes for Statistics/Forestry/Horticulture 571* by Erik V. Nordheim and Murray K. Clayton. Available as a course packet from Bob's copy shop.

**Computing.** We will be using the statistical package R, which is available for free download online at [cran.r-project.org](http://cran.r-project.org). R is free and available on all platforms (Windows, Mac and Linux). This tool is of growing importance in biology, with over 21 books published in 2009 alone (so far) about statistical computing with R<sup>1</sup>. There is no assumption in this course of prior experience with R. A tutorial is available on the course website. The first discussion will use go over this tutorial, so you are encouraged to bring your laptop to discussion on the first day, if you have one.

**Exams.** There will be two in-class midterm exams and a 2-hour final exam. All exams will be open book, open notes, and you will be allowed a calculator (but not a laptop). The first midterm exam will be on **Tuesday October 13<sup>th</sup>** and the second midterm exam will be on **Tuesday November 24<sup>th</sup>** before Thanksgiving. There will be no homework assigned the week before the midterms. The final exam will be on **Sunday December 20<sup>th</sup>** from 7:45am to 9:45pm, location TBA. Notice of any conflict with these dates must be given to the instructor within the first week.

**Grading.** Homework 20%, two midterms 20% each, final exam 40%. Letter grades will not be given for midterm exams, but information will be provided to let you know how you are doing in the class.

**Discussion Sections.** Attendance in discussion sections is strongly advised. You may attend any discussion for either lecture of 571, so long as there are not too many students in any one

<sup>1</sup>A list of books is available here: [www.r-project.org/doc/bib/R-books.html](http://www.r-project.org/doc/bib/R-books.html)

discussion. We ask that you commit to attend the same discussion section most of the time. Sections will begin meeting the week of September 8-10.

**H1N1 influenza.** We are all encouraged to stay home when sick (including instructors and TAs). Colleague coverage will be used as much as possible to continue instruction. Students who are sick will be responsible for getting class notes that they have missed and for making up assignments or exams within a reasonable period of time. Students do *not* need to communicate with instructors if they miss class or discussion for sickness. They need to contact the instructor by email in case they have to miss an exam. Students will *not* need to provide medical excuses for absences from flu-like symptoms. The situation calls for trust between all of us.

**Homework** will be assigned and posted on the course webpage on Thursdays, to be handed in by the following Friday by 4pm to your TA's mailbox. The mailboxes are in the hallway just inside the main University Ave. entrance to the Medical Sciences Center. You must show your work and organize it to get full credit. Late homework will be accepted only in extenuating circumstances, and only with one week's prior notice. Notice must be given to your instructor. Unexcused late homework will not receive more than half the credit. Late homework handed in after the solution is posted on the website will receive no credit. To prepare for the possibility of a flu pandemic, each student is allowed to drop one assignment. It is understood that students will skip an assignment due to sickness. No other special accomodation will be allowed for sickness, other than allowing for no-penalty late homework until the Monday when the solution is posted. If a student does not skip any assignment, the lowest assignment grade will be dropped to calculate the final assignment score.

**Academic honesty.** You are encouraged to work together with classmates, talk to your teaching assistant or instructor about your homework. We are convinced it is very beneficial to share and discuss ideas. However, you may not present other people's work as your own. If you work with other students solving problems, you still have to write up your own solution independently, run your own R computations independently and produce your graphs independently. You must work independently during exams. You may not share calculators or pass notes during exams.

**Laptop policy.** We may enjoy the wireless capability of the classroom so long as you stay on task. Advantages to using a laptop include: taking notes, viewing lecture notes rather than printing them, experimenting with R or other computing software, etc. There are also limitations; figures and sketches cannot be created on a notebook in the classroom for instance. However, activities such as emailing, web surfing and gaming are not allowed in class. They are a distraction to classmates: be respectful of others. Be sure the sound is off at the beginning of the class. In "no laptop times" laptop users will be asked to close their lids.

**Tentative schedule.** Chapter numbers refer to the text by Nordheim and Clayton (2).

R 9/3	Descriptive statistics	Chapter 2	Histograms, mean, variance
T 9/8 - R 9/10	Probability and random variables	Chapter 3	Set theory, conditional probability, independence. Probability distributions, expected value and variance of a random variable.
T 9/15 - T 9/22	Important probability distributions	Chapter 4	Binomial and normal distributions
T 9/22 - R 9/24	Sampling distributions	Chapter 5	Distribution of sample mean, central limit theorem, normal approximation to the binomial
T 9/29 - R 10/1	One-sample significance testing	Chapter 6	Normal and non-normal data, with and without known variance
T 10/6	Significance testing with binomial data	Chapter 6	Binomial test, z-test, chi-square goodness of fit test (1 by 2 tables, in Chapter 13)
R 10/8	Confidence intervals	Chapter 7	Construction and interpretation
T 10/13	Midterm	Chap. 2-6	
R 10/15	Confidence intervals	Chapter 7	(cont.)
T 10/20	Assessing Assumptions	Chapter 8	Assessment, corrective actions and robustness
R 10/22	Hypothesis testing	Chapter 9	Power and sample size determination
T 10/27 - R 10/29	Two-sample significance testing	Chapter 10	Boxplots, paired or independent samples, equal or unequal variance
T 11/3	Nonparametric methods for two samples	Chapter 10	Levene's test, Mann-Whitney test
R 11/5 - T 11/10	Comparing two proportions	Chapter 10	Z-test and confidence intervals, chi-square test of independence (2 by 2 tables, in Chapter 13)
R 11/12 - T 11/17	One-Way Analysis of Variance	Chapter 11	Anova tables, assumptions, F-test, contrasts
R 11/19	One-Way ANOVA and multiple comparisons	Chapter 12	Bonferroni method, Fisher's LSD, Q-method
T 11/24	Midterm	Chap. 6-11	
R 11/26	No class (Thanksgiving)		
T 12/1	One-Way ANOVA and multiple comparisons	Chapter 12	Bonferroni method, Fisher's LSD, Q-method (cont.)
R 12/3	Categorical data analysis	Chapter 13	Chi-square tests
T 12/8 - T 12/15	Simple linear regression	Chapter 14	Parameter estimation, assumption and assessment of fit
N 12/20	Final Exam	Chap. 2-14	Cumulative, Sunday 7:45am...