

Course Syllabus

[Jump to Today](#)

 [Edit](#)

Syllabus

Statistics 411/511 Methods of Data Analysis

Fall 2019

Instructor:

Lisa Madsen

Kidder 82

lisa.madsen@oregonstate.edu (<mailto:lisa.madsen@oregonstate.edu>) (Please do not use email for questions about homework or course material. Use [online Canvas discussions](#) instead.)

Office Hours: Monday and Wednesday 11:00-12:00; Other times possible by appointment.

TAs and their Office Hours:

Matt Klapman - Monday 3:00-4:00 pm; Friday 11:00-12:00 am

Chris Skypeck - Tuesday 12:00-1:00 pm; Thursday 1:00-2:00 pm

Lisa Wilson - Monday 9:00-10:00 am; Friday 12:00-1:00 pm

All TA office hours will be in the Statistics tutoring room, Weniger 205, between October 7 and December 6. You may attend any TA's office hours.

Lecture: MWF 10:00-10:50, LINC 128

Labs (all in Bexell 324):

M 12:00-12:50, Lisa Wilson

M 14:00-14:50, Lisa Wilson

M 17:00-17:50, Matt Klapman

T 11:00-11:50, Chris Skypeck

T 13:00-13:50, Chris Skypeck

T 16:00-16:50, Matt Klapman

Course Website: The Canvas course website is accessible at oregonstate.instructure.com/. You will need an ONID account (onid.oregonstate.edu/ (<http://onid.oregonstate.edu/>)) to log in. Course information and materials, including homework assignments, data sets, announcements, labs, example handouts, homework scores, etc. will be posted on the website. You should check the site daily and also periodically verify that your recorded scores are correct. The course will be listed as "ST 411," even if you are enrolled in ST 511 because it is a combined website.

Online Discussion Board: The course website allows [online discussions](#), which we will use instead of email for questions about homework, course material, and computing, since these may be of interest to several people.

Required Textbook: *The Statistical Sleuth*, Third Edition, by Ramsey and Schafer. The book is on three-hour reserve at the Valley Library. The second edition will be largely adequate, but the assigned problems may not be the same, so you should take these out of the third edition.

Outlines: Handouts of [lecture notes outlines](#) will be available on Canvas as I finalize them. You may want to print these out and bring to class so you can take notes on them as we cover them in the lecture. I will post my [annotated](#)

notes on Canvas after each lecture.

Lecture Capture: Audio and video of media projected on the screen will be "captured" and available on the course **Media Gallery** after each lecture, with an approximate one-day lag time.

Topics to be Covered:

- Chapter 1 Fundamental principles of statistical inference
- Chapter 2 Inference using t-tests and confidence intervals
- Chapter 3 Assumptions for using t-tools
- Chapter 4 Alternatives to t-tools
- Chapter 5 One-way ANOVA
- Chapter 6 Comparison of means
- Chapter 7 Simple linear regression
- Chapter 8 Assumptions for using simple linear regression

Prerequisite: **ST 351** (<https://catalog.oregonstate.edu/courses/st/>) or the equivalent. Know procedures: t and Z tests, confidence intervals. Understand concepts: random sample, probability distribution, normal curve, null hypothesis, p-value.

Learning Outcomes: After this course you should be able to

- Produce an appropriate analysis using R
- Defend your analysis by verifying assumptions
- Summarize your results clearly and without statistical jargon
- Critique a statistical analysis in your field of study (511 students only)

A Note for the ST 411 Students: This course is about 75% graduate students and 25% undergraduates. The graduate students often have their own data, or are in the process of collecting it, and they will then need to perform a data analysis for their theses. For **you** to get the most out of this class, you might look for a data set in a field that interests you. It will help you put the course material in context. A good place to start is **data.gov** (<https://www.data.gov/>), or ask a professor or graduate student in your major. You might also look for journal articles in your field.

Labs: These will be structured activities run by the TAs. They will be designed to give you practice using R, especially for the particular tasks required for the week's homework. The labs themselves do not require you to submit any work. The only thing you submit will be your completed homework assignment. You will probably save time and learn better if you attempt the computational parts of your homework shortly after completing the lab activity. Note that ST 411/511 is a course in statistics, not R. If you want more R instruction, please consider taking ST 599, Data Programming in R. You can also find abundant information about R online. If you find an online source you like, please share with the rest of the class in a Canvas discussion.

Lab Instructions: **Lab materials** will be posted on Canvas each week. The structure of the labs will allow you to work along with the TA in lab, or work at your own pace, either in the lab or not. If you want to work along with the TA in lab, please sit near the front. If you prefer to go to lab but work at your own pace, please sit near the back, and wait for the appropriate time to ask any questions. You don't need to turn in anything associated with the lab activity.

Homework: Homework is designed to help you practice statistical methods and think about statistical concepts. **Homework** will be posted on Canvas each Monday, submitted electronically on Canvas by Tuesday of the following week, and graded within one week. Some homework problems will involve analyzing data and reporting the results. You will be graded on your analysis *and* how you report results. Requirements and guidelines for the homework are

given below in this syllabus.

Late Homework Policy: Each student is allowed a maximum of two late homeworks. These must be submitted by 8 p.m on Wednesday, one day late. There are no exceptions to this policy. Later papers or papers exceeding the two-paper allowance will earn 0 points. This policy is to allow you some flexibility while maintaining uniform standards. You do not need permission to use a late homework allowance, and there is no penalty for doing so.

Homework Collaboration: You may interact with others on your homework, but everything you turn in must be your own work and in your own words. You may not share analyses, graphs, or any other materials, but sharing R code is allowed. Papers in violation of this policy will receive 0 points, and their authors will be reported to the OSU Student Conduct Committee. More information about academic honesty is given at studentlife.oregonstate.edu/studentconduct (<http://studentlife.oregonstate.edu/studentconduct>) and later in this syllabus.

Conceptual Exercises: Your textbook has several conceptual exercises at the end of each chapter. Answers are provided. You are responsible for working through these exercises, but these will not be collected or graded.

Exams: We will have one in-class midterm, scheduled for Friday, November 8 and one comprehensive final, scheduled for Wednesday, December 12, 6:00-7:50 pm. You may have one side of an 8.5 by 11-inch page of notes for the midterm and two sides of an 8.5 by 11-inch page of notes for the final. Plan to turn in the notes with the exam. Bring a calculator but no internet-accessing device.

Project: Due Monday, December 9. Read and critique the statistical analysis in a journal article of your choosing. This article should be from your field of study, and the statistical analysis should be one covered in this course. The report should be no longer than two pages (one double-sided page). More information will be available after the midterm. The project is required for ST511 and optional (but not extra credit) for ST 411.

How to Succeed in ST 411/511: To learn to do statistics, you need to **think** about it. This course provides several opportunities to engage with the material. The lecture outlines allow you to take structured notes during class or not, depending on what allows you to focus better. There will be time for questions during class. The labs give you exposure to useful computing tasks, as well as another look at course concepts, and another chance to ask questions. The homework is designed to provide motivation and structure for developing an understanding of the week's material. Canvas discussions provide quick answers so you don't spend so much time being confused that you get frustrated. A little confusion is normal and healthy, but be sure to ask for help before it turns into frustration.

Grading: Your final grade will consist of

Homework 8 @	10 points each
Midterm	65 points
Final	75 points
Project	25 points (optional for ST 411)
Total	245 points (220 for ST 411)

Letter grades will be assigned at the end of the term as follows:

92-100%	A	74-75.9%	C+
90-91.9%	A-	54-73.9%	C
88-89.9%	B+	52-53.9%	C-
78-87.9%	B	50-52.9%	D
76-77.9%	B-	0-49.9%	F

Regrades: These are available only if you believe there was an error made in grading your paper. Errors include totaling points incorrectly or misreading your solution. Errors do not include giving too little partial credit. Write a note explaining what the error was and resubmit your paper within one week of its return. If you received your paper late because you missed class, you do not get extra time to submit it for regrade.

Incompletes: Please read the information at [stat.oregonstate.edu/content/requests-incompletes](http://www.stat.oregonstate.edu/content/requests-incompletes) (<http://www.stat.oregonstate.edu/content/requests-incompletes>). Note: The deadline to withdraw with a W on your transcript is Friday, November 15.

Statistical Consulting: OSU students may take advantage of the Statistic Department's [free student consulting service](http://www.stat.oregonstate.edu/content/student-consulting-services) (<http://www.stat.oregonstate.edu/content/student-consulting-services>). Please contact them early so they can schedule your project.

Disability Accommodations: Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at ds.oregonstate.edu (<http://ds.oregonstate.edu>). DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

Academic Integrity: Academic or Scholarly Dishonesty is defined as an act of deception in which a Student seeks to claim credit for the work or effort of another person, or uses unauthorized materials or fabricated information in any academic work or research, either through the Student's own efforts or the efforts of another. Please read the full text of the [Student Conduct Code](http://studentlife.oregonstate.edu/code) (<http://studentlife.oregonstate.edu/code>).

Please note that *assisting*, helping another commit an act of academic dishonesty, is itself a violation of the Student Conduct Code.

It is important to avoid even the appearance of dishonesty. Any incidents of academic dishonesty will be dealt with according to the procedure described in the [Academic Dishonesty Report Form](https://studentlife.oregonstate.edu/sites/studentlife.oregonstate.edu/files/academic_misconduct_infographic2.pdf) (https://studentlife.oregonstate.edu/sites/studentlife.oregonstate.edu/files/academic_misconduct_infographic2.pdf).

Tentative Schedule:

Week	Events	Material
Week 0	First day of class; Introduction	Chapter 1
Week 1	Lab 1	Chapters 1,2
Week 2	Lab 2; Homework 1 due	Chapters 2
Week 3	Lab 3; Homework 2 due	Chapter 3
Week 4	Lab 4; Homework 3 due	Chapter 4
Week 5	Lab 5; Homework 4 due;	Chapter 5
Week 6	Lab 6; Homework 5 due; Midterm in class Friday 11/8	Chapters 5,6
Week 7	No labs or homework; Veteran's Day 11/11 Last day to withdraw Friday 11/15	Chapter 6
Week 8	Lab 7; Homework 6 due;	Chapter 7
Week 9	Lab 8; Homework 7 due	Chapter 7,8
Week 10	Lab 9; Homework 8 due; Thanksgiving 11/28-29	Chapter 8, Review

Week	Events	Material
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Week 11	Project due Monday 12/9; Final Thursday 12/12, 18:00-19:50	
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Homework Guidelines (These may be augmented during the term):

- **Homework must be typed.** Submissions must be in MS Word or pdf format.
- **Aim for conciseness and clarity.** Perform the specific tasks and answer the specific questions requested. You may want to include extra information for your own records, but please omit this extraneous material in what you submit.
- **Do not include computer code or output unless it is specifically requested.** When reporting results from an analysis, you may want to create your own table of values and refer to this table in a summary statement.
- **Do include R graphs when appropriate.** These should have an appropriate title and axis labels.
- **Statistical conclusions for hypothesis tests.** Hypothesis tests answer research questions like "is there a difference?" and "is there evidence for...?" A statistical conclusion for a hypothesis test should contain three elements: (1) a quantification of the evidence against the null in favor of the alternative, (2) a paraphrase of the hypotheses, and (3) the p-value and the test performed. For example, take the first sentence of the Statistical Conclusion for Case Study 2.1.1 at the bottom of page 29 of the textbook: "These data provide overwhelming evidence that the mean beak depth increased from 1976 to 1978 (one-sided p-value < 0.00001 from a two-sample t-test)." The elements are: (1) "overwhelming evidence," (2) "mean beak depth increased from 1976 to 1978," and (3) "(one-sided p-value < 0.00001 from a two-sample t-test)." Let's look at (2) more closely. The null and alternative hypotheses are $H_0 : \mu_1 - \mu_2 = 0$ and $H_A : \mu_1 - \mu_2 < 0$, where μ_1 is the population mean for 1976 and μ_2 is the population mean for 1978. The null says mean beak depth stayed the same from 1976 to 1978. The alternative says mean beak depth increased from 1976 to 1978. The alternative is always a negation of the null, so often a statistical conclusion will paraphrase the hypotheses just by referring to the alternative. For most of the tests we perform, the hypotheses refer to population parameters. Therefore, (2) should mention these parameters.
- **Statistical conclusions for confidence intervals.** Confidence intervals answer research questions like "how big?" A statistical conclusion for a confidence interval should contain three elements: (1) a statement indicating "estimation" and what quantity was estimated, (2) the endpoints of the confidence interval (point estimate optional), and (3) the confidence level. For example, take the second sentence of the Statistical Conclusion for Case Study 2.1.1 at the bottom of page 29 and top of page 30 of the textbook: "The 1978 (post-drought) mean was estimated to exceed the 1976 (pre-drought) mean by 0.67 mm (95% confidence interval: 0.28 mm to 0.96 mm)." The elements are: (1) "The 1978 (post-drought) mean was estimated to exceed the 1976 (pre-drought) mean," (2) "0.28 mm to 0.96 mm" (point estimate of difference is 0.67), and (3) "95%." Element (1) uses the term "estimated" and refers to the population means. It also says the 1978 mean was estimated to exceed the 1976 mean. We can say that because the entire confidence interval for the difference in population means is positive.