

## STA 6093 Introduction to Applied Statistics for Agricultural and Life Sciences (3 credits)

Spring 2022

Time and Location: **Online**

**\*\*\*THIS COURSE USES THE PROGRAMMING LANGUAGE R EXCLUSIVELY. YOU DO NOT NEED TO KNOW R COMING INTO THE COURSE, BUT YOU WILL KNOW IT WHEN YOU ARE FINISHED\*\*\***

### Instructors:

Ben Baiser, Building 116 Mowry Dr., 352-392-1947, [bbaiser@ufl.edu](mailto:bbaiser@ufl.edu)

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### Teaching Assistants

Head TA: Lauren Trotta ([lbtrotta@ufl.edu](mailto:lbtrotta@ufl.edu))

Grading TA: Tina Jackson ([t.jackson@ufl.edu](mailto:t.jackson@ufl.edu))

**Online Office hours:** Dr. Baiser: **Thursday 12am-1 pm**

TA, Lauren Trotta: **Thursday 4pm-5pm**

**Date and location of final exam:** All final exams will be taken on **Monday, April 25<sup>TH</sup>, 2022.**

- On-campus students (class number 17094 / section 1222) and international students that are at RECs (class number 17535/ section 05GF) will take the final **in-person** in CALS Computer Classroom - 3086 McCarty Hall B
- Domestic students at RECs (class number 17535/ section 05GF) and students in class number 17095 / section 19E0 will take the final exam online through **Honorlock**.

### Course Description:

This course provides students with a conceptual and practical understanding of the application of statistics in the agricultural and life sciences. This is an **online course** that will use a combination of lectures, programming demonstrations, data exercises **using the programming language R**, group discussions, and primary literature to teach introductory statistics at the graduate level. **This course is NOT a “go at your own pace” course. Each module must be completed in a specific week (see Course learning objectives and weekly schedule below).**

### Course goals:

- 1) Learn the programming language R
- 2) Familiarize students with the foundations of statistical analysis
- 3) Teach students basic statistical analysis and data management
- 4) Prepare students for advanced statistics courses they will take throughout their graduate career

**Course learning objectives:**

<b>Week</b>	<b>Module</b>	<b>Learning objectives</b>
1	1. Broad overview of statistics	<ul style="list-style-type: none"><li>• Describe the role of statistics in applied science.</li><li>• Identify the difference between a sample and the population.</li><li>• Describe observational studies and its weaknesses and strengths.</li><li>• Describe experimental studies and its weaknesses and strengths.</li></ul>
2	2. Reproducible science / R	<ul style="list-style-type: none"><li>• Describe the advantages of using a scripting computer language for statistical analysis.</li><li>• Define reproducible science.</li><li>• Download R and R studio.</li><li>• Know how to import and export data in R.</li></ul>
3	3. Knowing your data and Summary Statistics	<ul style="list-style-type: none"><li>• Describe the importance of querying and visualizing data.</li><li>• Be able to query and summarize data.</li><li>• Calculate and understand the meaning of summary statistics (measures of location and spread).</li></ul>
4	4. Visualizing your data and graphing your results	<ul style="list-style-type: none"><li>• Utilize graphical techniques to visualize your data</li><li>• Identify outliers using graphical techniques</li><li>• Create effective and innovative graphical displays of results</li></ul>
5	5. Random variables and probability distributions	<ul style="list-style-type: none"><li>• Define what is a probability and a probability distribution</li><li>• Describe the characteristics of the normal distribution.</li><li>• Explain why the normal distribution is so important</li></ul>
6	6. Hypothesis testing	<ul style="list-style-type: none"><li>• Define and develop a null hypothesis</li><li>• Define and develop alternative hypothesis.</li><li>• Identify when a result is “statistically significant”.</li><li>• Define precisely what a p-value is and how it is computed to reach the conclusion that a difference is not due to chance.</li><li>• Identify Type 1 error</li><li>• Identify Type 2 error</li></ul>
7	8. Linear models	<ul style="list-style-type: none"><li>• Mathematically define a linear model.</li><li>• Describe the four assumptions of linear models.</li><li>• Conduct diagnostic tests for assumptions.</li><li>• Transform data to meet the assumptions of linear models</li><li>• Recognize the limitations of data transformations.</li></ul>

8	7. T-tests	<ul style="list-style-type: none"> <li>• Know when a t-test is appropriate and which type of t-test to use (e.g., paired, two sample, one sample t-tests).</li> <li>• Apply a t-test to data.</li> <li>• Understand the problems associated with multiple statistical testing.</li> </ul>
9	9. ANOVA	<ul style="list-style-type: none"> <li>• Identify the types of data and experiments that an ANOVA is appropriate for.</li> <li>• Run an ANOVA in R</li> <li>• Calculate an F-statistic.</li> <li>• Test hypothesis with ANOVA</li> <li>• Interpret an ANOVA table and report ANOVA statistics.</li> <li>• Graphically display ANOVA results</li> </ul>
10	10. Simple regression	<ul style="list-style-type: none"> <li>• Know when regressions are appropriate</li> <li>• Run a regression in R</li> <li>• Be able to interpret and report regression outcomes.</li> <li>• Graphically display regression results</li> </ul>
11	11. Multiple regression	<ul style="list-style-type: none"> <li>• Identify the types of data and experiments that multiple regression is appropriate for.</li> <li>• Run a multiple regression in R</li> <li>• Detect multicollinearity among variables in multiple regression.</li> <li>• Interpret and graphically display interaction terms in multiple regression and ANOVA.</li> <li>• Define AIC scores.</li> <li>• Select models using stepwise procedures in R.</li> </ul>
12	12. Categorical data analysis	<ul style="list-style-type: none"> <li>• Identify the types of data and experiments that categorical data analysis is appropriate for.</li> <li>• Construct and interpret a contingency table.</li> <li>• Calculate and interpret a chi-square statistic.</li> </ul>
13	13. Monte Carlo tests	<ul style="list-style-type: none"> <li>• Be able to conceptualize appropriate null hypothesis and test statistics for different problems</li> <li>• Be able to implement simple Monte Carlo tests</li> <li>• Understand the pros and cons of Monte Carlo tests</li> </ul>
14	14. Future classes/analyses	<ul style="list-style-type: none"> <li>• Select the appropriate analyses for a given data type.</li> <li>• Know future options for quantitative topics and courses.</li> </ul>
<b>Final exam</b>		

### Assignment Types:

There are 4 types of graded assignments in this course:

- 1) Activities:** These are assignments **individual or group activities** that build on a modules content. They often involve finding and interpreting outside resources (e.g., popular science articles, scientific articles). **These assignments are present in select modules and thus are not due every week.** When a module does have an activity, it will be due on Sunday at 11:55pm (i.e., the end of the week's module)
- 2) Conceptual Quizzes:** These quizzes cover the basic concepts learned in each module and are open from Monday at 1:00 am to Sunday at 11:55pm each week. **Once you begin the conceptual quiz, you have 1 hour to complete it.**
- 3) Data Quizzes:** In the data quizzes, you will analyze data in R using the analyses you learned in each module. The data quizzes are open from Monday at 1:00 am to Sunday at 11:55pm each week. **Once you begin the data quiz, you have 3 hours to complete it.**
- 4) Discussion board:** We expect students to engage and provide meaningful contributions (posting questions, answers, or additional resources) to the weekly discussion boards. Participation in the discussion board will be factored into grading when students are on the cusp of a letter grade (e.g., B+). **Thus, the discussion board is an opportunity for you to help yourself but will not count against you in any way.**

### Due Dates for Assignments:

Assignment	Due
Discussion board	---
Activities	Sundays 11:55 pm
Conceptual Quizzes	Sundays 11:55 pm
Data Quizzes	Sundays 11:55 pm

### Grading:

Grading will be based on weekly quizzes (50% of the overall grade), activities (25% of the overall grade), and a final exam (25% of the overall grade). **Note that modules with more content have more quiz questions and are worth more points.**

Point range (%)	Letter Grade	GPA equivalent
93.0 – 100	A	4
90.0 – 92.9	A-	3.67
87.0 – 89.9	B+	3.33
83.0 – 86.9	B	3
80.0 - 82.9	B-	2.67
77.0- 79.9	C+	2.33
73.0 – 76.9	C	2
70.0 - 72.9	C-	1.67

67.0– 69.9	D+	1.33
63.0- 66.9	D	1
60.0 - 62.9	D-	0.67
< 60	E	0

Our philosophy is that you just learn by doing, thus this course is heavily based on working with data.

**\*\*\*We will drop your lowest grade for 1 quiz OR assignment (not including the final exam) \*\*\***

**List of required and recommended materials**

*Textbooks (recommended):*

- Gotelli NJ and AM Ellison. "A primer of ecological statistics", Second Edition. *Sinauer, Sunderland, Massachusetts, USA* (2013).
- Crawley, Michael J. "Statistics: an introduction using R." *Wiley*, (2005)

*Software (Required):*

- R, freely available at <http://www.r-project.org>
- A text editor, such as RStudio (<http://www.rstudio.com/>)

**Pre-requisites:** One undergraduate course in statistics

**Class attendance:** You are required to complete each module component by the due date. If you are an on-campus or REC international student, you are required to be present for the final exam. **If you need to miss class due to field work or conferences, you must inform the instructor at least 2 weeks in advance.**

**Class participation:** You are expected to participate in and class discussion boards via the internet.

### **Attendance and Make-Up Work**

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

### **IT help**

A hardwired internet connection (not wireless) is highly recommended when working on quizzes and/or submitting assignments. If you have problems with CANVAS, you should contact:

- a) Staff in the SFRC online programs office by posting a question in the appropriate forum
- b) UF computing help desk “e-Learning Support Services” ([learning-support@ufl.edu](mailto:learning-support@ufl.edu) or (352) 392-4357 -> option 2 (Students))

These resources are also listed in the “Help!” tab on the left-hand side of Canvas.

### **Problems with R:**

99.9% of problems with R should be solved within your peer group on the discussion board. In the off chance that no one on the discussion board can solve your problem, email your T.A.

### **Online Course Evaluation Process**

Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

### **Academic Honesty**

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *“We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.”* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *“On my honor, I have neither given nor received unauthorized aid in doing this assignment.”*

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

**Software Use:**

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

**Services for Students with Disabilities**

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation. 0001 Reid Hall, 352-392-8565, <https://disability.ufl.edu/students/get-started/>.

**Campus Helping Resources**

Each online distance learning program has a process for, and will make every attempt to resolve, student complaints within its academic and administrative departments at the program level. See <http://distance.ufl.edu/studentcomplaints> for more details.

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- *University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, [www.counseling.ufl.edu/cwc/](http://www.counseling.ufl.edu/cwc/)*  
Counseling Services  
Groups and Workshops  
Outreach and Consultation  
Self-Help Library  
Wellness Coaching
- *Career Resource Center, First Floor JWRU, 392-1601, [www.crc.ufl.edu/](http://www.crc.ufl.edu/)*