STA 6093 Introduction to Applied Statistics for Agricultural and Life Sciences (3 credits)
Fall 2017
Time and Location: **Online**

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

Instructors:
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Teaching Assistants
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Office hours: Virtual Office hours: Dr. Valle: **Thursday 12-1 pm**   Maryada Shrestha: **Thursday 3-4pm**

Date and location of final exam: All final exams will be on **Monday Dec 11, 2017**.
- **On-campus students** (Section 109F) and **international students that are at RECs** (Section 109D) will take the final **in-person** in room 3806 McCarty Hall B.
- **Domestic students at RECs** (Section 109D) and **students in Section 1098** will take the final exam **online** through Proctor U.

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 activities, 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:

Week	Module	Learning objectives
1	1. Broad overview of statistics	- Describe the role of statistics in applied science. - Identify the difference between a sample and the population. - Describe observational studies and its weaknesses and strengths. - Describe experimental studies and its weaknesses and strengths.
2	2. Reproducible science / R	- Describe the advantages of using a scripting computer language for statistical analysis. - Define reproducible science. - Download R and R studio. - Know how to import and export data in R.
3	3. Knowing your data and Summary Statistics	- Describe the importance of querying and visualizing data. - Be able to query and summarize data. - Calculate and understand the meaning of summary statistics (measures of location and spread).
4	4. Visualizing your data and graphing your results	- Utilize graphical techniques to visualize your data - Identify outliers using graphical techniques - Create effective and innovative graphical displays of results
5	5. Random variables and probability distributions	- Define what is a probability and a probability distribution - Describe the characteristics of the normal distribution. - Explain why the normal distribution is so important
6	6. Hypothesis testing	- Define and develop a null hypothesis - Define and develop alternative hypothesis. - Identify when a result is "statistically significant". - Define precisely what a p-value is and how it is computed to reach the conclusion that a difference is not due to chance. - Identify Type 1 error - Identify Type 2 error
7	8. Linear models	- Mathematically define a linear model. - Describe the four assumptions of linear models. - Conduct diagnostic tests for assumptions. - Transform data to meet the assumptions of linear models - Recognize the limitations of data transformations.

8	7. T-tests	• Know when a t-test is appropriate and which type of t-test to use (e.g., paired, two sample, one sample t-tests). • Apply a t-test to data. • Understand the problems associated with multiple statistical testing.
9	9. ANOVA	• Identify the types of data and experiments that an ANOVA is appropriate for. • Run an ANOVA in R • Calculate an F-statistic. • Test hypothesis with ANOVA • Interpret an ANOVA table and report ANOVA statistics. • Graphically display ANOVA results
10	10. Simple regression	• Know when regressions are appropriate • Run a regression in R • Be able to interpret and report regression outcomes. • Graphically display regression results
11	11. Multiple regression	• Identify the types of data and experiments that multiple regression is appropriate for. • Run a multiple regression in R • Detect multicollinearity among variables in multiple regression. • Interpret and graphically display interaction terms in multiple regression and ANOVA. • Define AIC scores. • Select models using stepwise procedures in R.
12	12. Categorical data analysis	• Identify the types of data and experiments that categorical data analysis is appropriate for. • Construct and interpret a contingency table. • Calculate and interpret a chi-square statistic.
13	13. Monte Carlo tests	• Be able to conceptualize appropriate null hypothesis and test statistics for different problems • Be able to implement simple Monte Carlo tests • Understand the pros and cons of Monte Carlo tests
14	14. Future classes/analyses	• Select the appropriate analyses for a given data type. • Know future options for quantitative topics and courses.
	Final exam	

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 Friday 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 Friday at 1:00 am to Sunday at 11:55pm each week. **Once you begin the data quiz, you have 3 hour 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 (15% of the overall grade), group participation (10% 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 and interacting with your fellow group members.

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

List of required and recommended materials
Textbooks (required):
Gotelli NJ and AM Ellison. "A primer of ecological statistics", Second Edition. *Sinauer, Sunderland, Massachusetts, USA* (2013).

Textbooks (recommended):
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: 1 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 group and class activities (e.g., discussion boards) via the internet. Instructions of group activities will be detailed within the corresponding module.

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

Problems with CANVAS:
e-Learning Support Services
E-mail: learning-support@ufl.edu
Phone: (352) 392-4357 -> option 2 (Students)

Problems with R:
99.9% of problems with R should be solved within your group. In the off chance that no one in you group 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, **www.dso.ufl.edu/drc/**

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/**
  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/**