Course Syllabus – TRBIO 520

Course Information

Course Number: TRBIO 520 SP23
Course Name: Advanced Methods in Statistical Analysis
Term: SP 2023
Start Date: 04/03/2023
End Date: 06/23/2023
Credits: 3.0

Meeting Days / Times

Mondays and Wednesdays, 1:00-2:30pm PT / 4:00-5:30pm ET
(See Calendar in Canvas for the most up-to-date schedule.)

Location

CA: Large Conference Room (Hazen Theory Building)
FL: B214
Online via Zoom

Course Managers

Role	Last Name	First Name	Email Address
Course Director	Wineinger	Nathan	nwineing@scripps.edu
TA	Chen	Shaun	sfchen@scripps.edu
TA	Min	Charles	cmin@scripps.edu

Course Description

This course introduces students to more advanced methods in statistical analyses. The course topics include multivariable and generalized linear models, survival analysis and repeated measures, approaches to simulate data, study design considerations and statistical power, summarizing and validating statistical results, dimensionality reduction for wide data, and an introduction to Bayesian statistics. Topics will be covered on a weekly basis and include a didactic lecture followed by an applied lab where students will perform statistical analyses in class. The course is meant to prepare students for common statistical analysis issues that may arise in their own research, but when more introductory approaches are not appropriate. At the conclusion of the course, students will present the results from an assigned data analysis task to the class, demonstrating their technical skill and their ability to interpret these findings.

Program Learning Outcomes

By the end of the program, students will have accomplished these objectives:
PLO1: Original Research – graduate students are expected to develop the skills critical for generating high-quality research output. This would include absorbing, recalling, and contextualizing scientific knowledge, evaluating scientific information and data, creating testable hypotheses and investigating hypotheses, mastering scientific tools and techniques, displaying ethical behavior, and receiving and giving feedback.
PLO2: Communication – graduate students are expected to demonstrate the oral, written, and media skills to effectively communicate the impact of a study or a body of work to the greater scientific community and to the public at large using a number of methods.
PLO3: Critical Thinking – graduate students are expected to develop a self-directed process to analyze information, form opinions or judgments, and use this process to improve the quality of their scientific thoughts, navigate problems, and make informed decisions.
PLO4: Intellectual Curiosity – graduate students are expected to acquire the capacity to build their intellectual curiosity and demonstrate problem solving approaches that serve their professional growth and ability to impact a field.
PLO5: Career and Professional Development – graduate students are expected to develop a variety of transferable skillsets throughout their graduate experience, including management and leadership, inclusiveness, resilience, scientific rigor, collaboration, accountability, time management, teamwork, networking, and career planning.

Course Learning Outcomes

Upon completion of this course students will be able to:
CLO1: Recognize appropriate statistical methods.
CLO2: Perform statistical analyses.
CLO3: Interpret statistical results.
CLO4: Present statistical results.

Background Preparation (Prerequisites)

Students should have taken the *Introduction to Biostatistics* class or equivalent. Basic R programming skills are required.

Course Materials

N/A

Class Format

Generally, Monday classes will include didactic lectures on course topics, and Wednesdays will be an in-class data analysis lab covering these topics. Four homework assignments, an in-class and take-home midterm, and final presentation will be assigned.

Expectations and Logistics

Students should bring a laptop to the Wednesday labs.

Attendance Statement

Students are expected to attend all classes. Students who are unable to attend class must seek permission for an excused absence from the course director or teaching assistant. Unapproved absences or late attendance for three or more classes may result in a lower grade or an "incomplete" for the course. If a student has to miss a class, he or she should arrange to get notes from a fellow student and is strongly encouraged to meet with the teaching assistant to obtain the missed material.

Scientific and Professional Ethics

The work you do in this course must be your own. Feel free to build on, react to, criticize, and analyze the ideas of others but, when you do, make it known whose ideas you are working with. You must explicitly acknowledge when your work builds on someone else's ideas, including ideas of classmates, professors, and authors you read. If you ever have questions about drawing the line between others' work and your own, ask the course professor who will give you clear guidance. Exams must be completed independently. Any collaboration on answers to exams, unless expressly permitted, may result in an automatic failing grade and possible expulsion from the Graduate Program.

Technology Requirements and Support

For issues related to Canvas, please contact the Graduate Office by email at: gradprgm@scripps.edu or by phone at: 858-784-8469.

Course Grading

Grading is in accordance with the academic policies of the Skaggs Graduate School. The breakdown of grading is as follows:

- Homework: 40% (4x10%)
- Midterm Exams: 30% (15% in-class, 15% take-home)
- Final Presentation: 30%

Letter Grade	Percent	GPA	Description
A	93-100	4.00	Outstanding achievement. Student performance demonstrates full command of the course subject matter and evinces a high level of originality and/or creativity that far surpasses course expectations.
A-	90-92	3.67	Excellent achievement. Student performance demonstrates thorough knowledge of the course subject matter and exceeds course expectations by completing all requirements in a superior manner.
B+	87-89	3.33	Very good work. Student performance demonstrates above-average comprehension of the course subject matter and exceeds course expectations on all tasks as defined in the course syllabus. There is notable insight and originality.
B	83-86	3.00	Satisfactory work. Student performance meets designated course expectations and demonstrates understanding of the course subject matter at an acceptable level.
B-	80-82	2.67	Marginal work. Student performance demonstrates incomplete understanding of course subject matter. There is limited perception and originality.
C+	77-79	2.33	Unsatisfactory work. Student performance demonstrates incomplete and inadequate understanding of course subject matter. There is severely limited or no perception or originality. Course will not count toward degree.
C	73-76	2.00	Unsatisfactory work. Student performance demonstrates incomplete and inadequate understanding of course subject matter. There is severely limited or no perception or originality. Course will not count toward degree.
P	73-100	0.00	Satisfactory work. Student performance demonstrated complete and adequate understanding of course subject matter. Course will count toward degree.
F	0-72	0.00	Unacceptable work/Failure. Student performance is unacceptably low level of knowledge and understanding of course subject matter. Course will not count toward degree. Student may continue in program only with permission of the Dean.
I		0.00	Incomplete is assigned when work is of passing quality but is incomplete for a pre-approved reason. Once an incomplete grade is assigned, it remains on student's permanent record until a grade is awarded.
W		0.00	Withdrew from the course with Dean's permission beyond the second week of the term.

- All courses will be recorded and maintained in the student's permanent academic record; only courses that apply towards the degree will appear on the academic transcript. Non-credit or audited courses will not appear on the transcript.
- 4 core courses taken for a letter grade (pass = B- or higher for a core course)
- 2 elective courses taken pass/fail (pass = A, B, C for an elective)

Course Summary:

Date	Details
Mon Apr 3, 2023	**Review of statistical principles**
Wed Apr 5, 2023	**Introduction**
	Review of R programming and notebooks
	Week 0 quiz
Mon Apr 10, 2023	**Multivariable regression**
Wed Apr 12, 2023	**Lab**
Mon Apr 17, 2023	**Generalized linear models**
Wed Apr 19, 2023	**Lab**
	Homework #1
Mon Apr 24, 2023	**Survival analysis**
Wed Apr 26, 2023	**Lab**
Mon May 1, 2023	**Repeated measures and autocorrelation**
Wed May 3, 2023	**Lab**
	Homework #2
Mon May 8, 2023	**Review**
	Simulating data
Wed May 10, 2023	**Lab**
	Take Home Midterm
Mon May 15, 2023	**Statistical power**
Wed May 17, 2023	**Lab**
Fri May 19, 2023	**Commencement (No Class)**
Mon May 22, 2023	**Cross validation and meta-analysis**
Wed May 24, 2023	**Lab**
	Homework #3
Mon May 29, 2023	**Memorial Day (No Class)**
Wed May 31, 2023	**Dimensionality reduction and shrinkage**
Mon Jun 5, 2023	**Lab**
Wed Jun 7, 2023	**Overview of final presentations**
Mon Jun 12, 2023	**Bayesian statistics**
	Homework #4
Wed Jun 14, 2023	**Lab**
Mon Jun 19, 2023	**Juneteenth (No Class)**
Wed Jun 21, 2023	**Final presentations**