BI 412 BIOMETRICS
Fall 2024
Dr. Jolley
Lecture M/W 12:30–1:50 a.m. SC 101
Lab M or T 2:00-4:50

I. Course Time and Location

Moodle Course Shell:	BI-412-02/L03 - BIOMETRICS/BIOMETRICS LABORATORY - FA'24 - R. Jolley (enrollment key: bi41202l03fa24)
Course Days & Time:	12:30–1:50 p.m. Monday and Wednesday in SC 101

II. Instructor Contact Information

Instructor:	Dr. Rachel Jolley
Office:	SC 108 first floor of the Science Building)
Office Hours:	Mon & Wed 8:30–11:30 a.m.
Email:	rachel.jolley@triton.uog.edu

III. Course Description

Experimental design and methods for statistical analysis of biological data, with an emphasis on inquiry using the scientific method.

IV. Course Overview

The goal of this course is to help students understand how statistics are used as a tool in experimental biology. We will discuss how to design experiments, interpret biological data, and how to formulate hypotheses to be tested. This course will cover the fundamentals of experimental design and summary statistics.

Students will take a corresponding lab in conjunction with this course. The lab is designed to help you learn R and practice the concepts learned in lecture. You will turn in a completed assignment at the end of each lab. The lab grade is separate from the lecture grade.

V. Learning Outcomes

The goal of this course is to provide students with a fundamental understanding of experimental design and statistics. By the end of the semester, you should be able to: 1) determine how to properly visualize a data set, 2) be able to calculate and interpret basic summary statistics, 3) test hypotheses based on the question being addressed and the distribution of the data, 4) choose the correct statistical test for that hypothesis, and 5) be able to identify potential sources of bias in the experimental design of a study.

VI. Textbook

Whitlock, M. C. and Schluter, D. 2014. *The Analysis of Biological Data* (3rd Edition). Roberts and Company Publishers.

Website for data sets, R code, and tutorials: https://whitlockschluter3e.zoology.ubc.ca

VII. Required Skills and other Resources

There are certain skills and equipment needed as well as other resources such as Internet access. Here are some things you will need in order to take this class:

- Reliable access to a computer with broadband Internet access. Broadband Internet access is commonly available for residential customers. The UOG campus also has a few computer labs for student use.
- A desktop or laptop computer is required. Mobile devices such as iPads, Android tablets, and smart phones are not recommended as they may have compatibility issues. You may use them for convenience to view most content for this class, but you should use a full computer for the more important class activities.

VIII. General Policies for BI 412

- Review the corresponding chapters in the textbook prior to lecture.
- Attendance is required and is part of your grade.
- Attending exams is mandatory. You will be excused from a lecture exam only in the case of a major emergency (e.g., illness, family tragedy, etc.). These emergencies must be documented and medical excuses require a physician's note. If something stops you from attending class—go see your instructor. There will be no make-up quizzes or exams—If you miss an exam for a reason your instructor considers valid, your instructor will average it out of your score, otherwise your score = 0.
- Exams will be delivered in class through the course Moodle page. Do not log out of an examination until you have finished the exam in its entirety.
- If you show up late to a quiz or exam, you do not get any additional time to complete the test. Furthermore, students who show up to the test AFTER any quizzes or exams have been turned in by other students will not receive a test.
- If something prevents you from attending class, or if your instructor cannot give a class because of absence, typhoon, etc., you are still responsible to keep up with the reading/study; contact a classmate for copies of notes if necessary.
- No extra-credit assignments or extra-credit exams will be given.
- Academic dishonesty: All quizzes and exams must be your own work. The term "plagiarism" includes, but is not limited to, the use, by paraphrase or direct quotation, of the published or unpublished work of another person without full and clear acknowledgment. It also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials. If you are not sure what plagiarism is and how to avoid it in using sources for your work, see www.indiana.edu/~wts/pamphlets/plagiarism.shtml—but be careful when paraphrasing not to change the meaning of scientific information.

Plagiarism will result in a final grade of “F” in this class. Similarly, the answers that you write on exams must come from inside your head or the information supplied in the quiz or test; anything else is cheating. The term “cheating” includes, but is not limited to: (1) use of any unauthorized assistance in taking quizzes or exams, e.g., looking at other students’ answers or getting information from another person via any kind of communication; (2) dependence upon the aid of sources beyond those authorized by the instructor in solving problems, or carrying out other assignments; or (3) the acquisition, without permission, of quizzes, exams or other academic material belonging to a member of the University faculty or staff. If you need to use an electronic translator, you must discuss this with your instructor in advance. Cheating on any assignment will result in a final grade of “F” in this class for all students involved, including those who allowed other students to obtain or read their answers.

- The use of Chegg.com and other similar websites to complete course assingments and tests is strictly prohibited and will result in you receiving an F for this course.
- Inappropriate behavior online will result in removal from the lecture and potentially from the class, depending on the severity of the offense. Harassment, including during online lectures, will be grounds for referral to SDAC.

IX. Virtual Classroom Interaction

There are a number of things to keep in mind with regards to interaction in the virtual classroom.

- Communicating with the Instructor
    - At any point during this course, you are welcome to contact me via email with questions regarding grades, instructions, advisement, or even for personal issues. I check my email frequently and will typically respond to messages within 24 hours.
    - I have included an “Ask the Instructor” forum in the class where you can post any questions you might have regarding the class. I will post answers to your questions in this forum so that you, and anyone else with the same questions, can always refer back to the forum for answers. Students are also welcome to provide their own answers and feedback based on their own experience. Such sharing of information allows us all to help each other.
- Communicating with classmates
    - In the virtual classroom, you will see a “Participants” list in the left column. This will include links to all students enrolled in the class. You will be able to send messages through this system or you can send them email messages directly.
- Online Etiquette (aka: Netiquette)
    - Do not SHOUT. Using All Caps when you type is considered to be “shouting” online. Remember to turn off your Caps Lock.
    - Be prompt. Follow class schedules and respond to email messages promptly.
    - Participate. Participation is part of your grade and also helps to move the class along. Especially for group activities, be sure to do your share of the

work.

- No flaming, trolling, or cyber bullying. You are all expected to be respectful and professional. If you have any concerns with classmates, please contact your instructor regarding the problem.
- Stay on topic and try to back up any claims or statements that you make.
- Do not dominate any discussion. Give other students the opportunity to join in the discussion.
- Use and cite credible sources.
- Do not plagiarize.
- Avoid jokes and sarcasm as these are often misinterpreted online.
- Use emoticons if they will help to convey the tone of your message.
- Always re-read what you type before you send it. Remember that you cannot take back anything that you post. Also remember that people cannot see you or hear you. That means that they cannot see your body language or hear the tone of your voice. They can only rely on what you type. So, try to make sure that what you type cannot be misinterpreted. Be clear and brief.
- Be patient and open-minded. Do not judge others or jump to conclusions. Remember that, just as others might misunderstand you… you might misunderstand them. If something sounds confusing or offensive, ask for clarification before you jump to conclusions. Never respond out of emotion because what you say online can stay online and may be used against you in the future. Also remember that other students may not be native English speakers and may have difficulty in saying what they really mean online.
- Respect the privacy of others. Do not post or communicate personal or confidential information in the virtual classroom.
- Remember that the UOG Moodle system keeps logs of all your activity inside of UOG Moodle.

X. Student Learning Outcomes

Students completing this course of study of Biometrics and Biometrics Laboratory will be able to achieve the following learning outcomes:

Intended Student Learning Outcomes	Biology Program Learning Outcomes	Institution Learning Outcomes
1. Define mathematical terms related to statistics and probability theory as it is applied in biology	1-d, 2, 3	2
2. Use a computer scripting language to write programmers of inferential statistical tests	1-d, 2, 3	3
3. Design biological experiments based on a sound statistical basis	1-b, 1-c, 5,6	1, 2, 5, 7

IX. Assignments

There will be several assignments throughout the semester that will comprise your grade for this course. These are as follows:

- Homework will come from the textbook. You will be required to show your work on each problem (include your R code). Answers to the homework can be found in the back of the book so that you can check your answers. If you provide only the answer found in the back of the book and no evidence to support your work, you will get a 0.
- Exams will assess your ability to analyze data, and to apply statistical tests to form an inference (i.e., a conclusion). These tests (including the final exam) are not cumulative, but they are scaffolded so that we will draw on principles from previous exams. Exams will be administered via Moodle during class.
- Late assignments will be deducted 10% of the grade for every day that it is late. The exceptions are the exams which cannot be submitted late under any circumstance.

X. Lecture Grading System

Final grades earned by students taking Biometrics are based on cumulative points totaled from all exams, quizzes, and practical work completed during the course of the semester. The total number of points is distributed as follows:

Attendance. 10%
Homework/Misc. Assignments 40%
Unit Exams(4 @ 100 pts ea.) 50%
Total. 100%

XI. Lab Grading System

The lab grade is separate from your lecture grade. Lab assignments are due at the end of each lab period.

Lab assignments (12@ 100 pts ea.).....100%

We will be using a +/- system this semester, which is an improvement over the system we have traditionally used. The percentage thresholds and corresponding letter grades are shown below:

Letter Grade	Grade Point Value	Percent Grade	Definition	
A+	4.00	98-100%	Outstanding	Honors-level performance with superior quality and extraordinary distinction.
A	4.00	93-97%		

A-	3.67	90-92%		
B+	3.33	87-89%	Good	Solid accomplishment, indicating a substantial mastery of course materials and a good command of skills required by the course.
B	3.00	83-86%		
B-	2.67	80-82%		
C+	2.33	77-79%	Adequate	Students have achieved the level of competency needed for advancing to a subsequent course which has this course as pre-requisite.
C	2.00	70-76%		
D	1.00	60-69%	Deficient	Minimal passing, but not adequate to take a subsequent course which has this course as pre-requisite.
F	0.00	<60%	Failure	Inadequate to receive credits.
P	Pass			
I	Incomplete			
NC	No Credit			

XV. Tentative Course Outline

Lecture Schedule:			**Required Reading**:
Aug.	14	BI 412 Course mechanics	
	19	Introduction to Statistics	Ch.1
	21	Displaying Data	Ch. 2
	26	Describing Data	Ch. 3
	28	Estimating with uncertainty	Ch. 4
Sept.	**2**	**Holiday (Labor Day)**	
	4	Probability	Ch. 5
	9	Probability	Ch. 5
	11	Hypothesis Testing	Ch. 6
	16	**Exam I (chapters 1-5)**	
	18	Analyzing Proportions	Ch. 7
	23	Probability models	Ch. 8
	25	Probability models	Ch. 8
	30	Contingency Analysis	Ch. 9
Oct.	2	Contingency Analysis	Ch. 9
	4	Normal Distribution	Ch.10
	7–12	**Fanuchånan Break**	
	14	t-distribution	Ch. 11
	16	Comparing 2 means	Ch. 12
	21	**Exam II (chapters 6-11)**	

	23	Comparing 2 means	Ch. 12
	28	Handling violations of assumptions	Ch. 13
	30	Handling violations of assumptions	Ch. 13
Nov.	4	Designing experiments	Ch. 14
	6	Comparing means of more than 2 groups	Ch. 15
	11	**Veterans Day**	
	13	Correlation between numerical variables	Ch. 16
	18	Correlation between numerical variables	Ch. 16
	20	**Exam III (chapters 12-16)**	
	25	Regression	Ch. 17
	27	Regression	Ch. 17
	29	Regression	Ch. 17
Dec.	2	Analyzing multiple factors	Ch. 18
	4	Analyzing multiple factors	Ch. 18
	11	**Final Exam 12:00 – 13:50**	

Lab Schedule

Aug	19/20	Loading R and Rstudio
	26/27	Intro to R, part 1 and 2
Sept	2/3	**No lab (Labor day)**
	9/10	Graphics
	16/17	Making data files for R
	23/34	Sampling
	30/1	Describing data
Oct	7/8	**Spring Break**
	14/15	Frequency data
	21/22	Contingency analysis
	28/29	Normal distribution and sample means
Nov	4/5	Comparing means of two groups
	11/12	**No lab (Veterans' day)**
	18/19	ANOVA
	26/27	Correlation and regression

XI. Instructor's Statement on Accessibility

An accessible and inclusive classroom is critical for student success. It is my goal to create an online environment that is welcoming and that provides access for all students, including those with disabilities that may impact their ability to fully engage with this course. If you require specific accommodations to facilitate your learning experience, please contact me so that we can discuss reasonable options or adjustments. In addition, the UOG Student Counseling and Advising Service Disability Support Services (DSS; see below) is available to all students requiring assistance and accommodations at UOG.

XII. DSS Accommodation Services

In accordance with the Americans with Disabilities Act (ADA) of 1990 and the Rehabilitation Act of 1973, the University of Guam does not discriminate against students and applicants on the basis of disability in the administration of its educational and other programs.

If you are a student with a disability who will require an accommodation(s) to participate in this course, please contact the Student Counseling and Advising Service Disability Support Services office to discuss your specific accommodation needs confidentially. A Faculty Notification letter will be emailed to me specifying your approved accommodations. If you are not registered, you should do so immediately at the Student Center, Rotunda office #5, sssablan@triton.uog.edu or ph/TTY: 735-2460, to coordinate your accommodation request.

XIV. Student Support:

The following is a list of resources that students can turn to when they need support:

- Problems with the course instructions or other content?
  Contact your Instructor for clarification and assistance.
- Technical problems with UOG Moodle system?
  Contact the UOG Moodle Help team by email at moodlehelp@triton.uog.edu or by phone at (671) 735-2620.
- Problems with WebAdvisor or GoTritons student email service?
  Contact the UOG Office of Information Technology (aka: the Computer Center) by email at helpdesk@uog.edu or by phone at (671) 735-2640.
- UOG Library Resources and Services
- UOG Student Services provides a number of key resources for students, including the Admissions and Records office, Financial Aid office, Student Life office, Housing and Residence, Counseling, Student Health, and other services.

XVIII. Appendix of Program Learning Outcomes

Biology Program Learning Outcomes

BI PR-1: Disciplinary Knowledge and Skills

A. Graduates have advanced understanding of the nationally recognized core competencies in biology. Students taking biology for GE will have a basic grasp of some of these concepts, especially those relating to the interface of science and society, and will advance their scientific literacy. Students contribute to the public good by using their knowledge and skills in internships, research and volunteering, and in responsible use of natural resources and technology.

B. Graduates use their knowledge and skills to solve problems in ecology, genetics, molecular biology, systematics, and evolution. They can apply their knowledge and skills to locally important issues such as island biogeography, conservation, and endangered species problems; they are also prepared to address broader questions such as biomedical research. They apply elements of thought and intellectual standards to problem solving and effectively judge the usefulness and accuracy of external sources of information.

C. Graduates approach scientific questions using scientific criteria and know how these criteria differ

from those in other disciplines and other worldviews.

D. Graduates and GE students have metaknowledge of the diverse ways in which scientists in various disciplines think and work, and how these ways differ from and are useful to public policy making.

BI PR-2: Interdisciplinary Knowledge and Skills
Graduates apply relevant concepts from chemistry and physics to biology problems; they approach problems in terms of interdisciplinary teams, where appropriate, aware of how other branches of biology and other sciences could be used to "come from the question."

BI PR-3: Quantitative Skills
Graduates apply numerical methods in collection and analysis of biological data. They formulate testable hypotheses and create effective experimental designs using their knowledge, understanding, and practical experience of scientific instruments and statistics.

BI PR-4: Research Skills for Laboratory and Field
Graduates are competent in basic biology procedures and safety in the laboratory and field.

BI PR-5: Communication Skills
Graduates use scientific literature and diagrams as a source of information, properly cite sources and avoid plagiarism, and use computer software to create text and graphics to communicate results effectively through print and oral presentations. They take initiative in searching for relevant sources in the scientific literature and assess evidence in writing scientific proposals and reports.

BI PR-6: Digital Literacy
Graduates have experience with contributing to and using large databases in bioinformatics, environmental sciences, and biological collections and have the general knowledge and confidence to mine "big data" sources.

BI PR-7: Professionalism
Graduates follow ethical principles involved in science, ranging from integrity and honesty to authorship criteria; ownership of samples and data; appropriate manipulation of data and images; and (where appropriate) ethical issues in human subject and animal research.

UOG Institutional Learning Outcomes

ILO 1: Mastery of critical thinking and problem solving
ILO 2: Mastery of quantitative analysis
ILO 3: Effective oral and written communication
ILO 4: Understanding and appreciation of culturally diverse people, ideas and values in a democratic context
ILO 5: Responsible use of knowledge, natural resources and technology
ILO 6: An appreciation of the arts and sciences
ILO 7: An interest in personal development and lifelong learning