

ENTM 30100: Experimentation & Analysis

Fall Semester 2019

Credits: 3

Course Meeting Times: Tuesday and Thursday, 1:30-2:45 pm

Location: SMTH 201

Instructor: Dr. Douglas Richmond

Phone: 494-0399

E-mail: drichmond@purdue.edu

Office: SMTH 105C

Office Hours: by appointment

Course Description

This course introduces students to the basic concepts of experimental design and quantitative data analysis with a focus on insect examples. The first half of the course explores the factors necessary for designing a successful experiment, whereas the second half focuses on data analysis and interpretation using common mathematical models. Examples are drawn primarily from insect biology and agricultural science, but are useful for all undergraduate students planning careers in the life sciences.

Course Objectives

Students should be able to:

- Design and conduct an experiment that recognizes and avoids common pitfalls
- Apply the general linear model and its variants in data analysis
- Appropriately use a common data analytics software platform

Insect Biology Discipline-Specific Outcomes

This course is designed to assess student achievement toward the following insect biology learning outcomes:

- Quantitatively analyze data
- Use observation and experimentation to generate data with methodological transparency and reproducibility
- Evaluate the scientific process as to accuracy, precision, and error sources and mitigation

Prerequisites

- STAT 30100

Required Textbooks and other learning materials:

- Ruxton, G. and N. Colgrave. 2016. Experimental Design for the Life Sciences, 4th edition. Oxford University Press, 114 pp.
https://www.amazon.com/Experimental-Sciences-Behavioural-Physiological-Ecology/dp/0198717350/ref=dp_ob_title_bk
- Analytics Software: Statistica 13.3 Basic Academic Bundle (Free)
<https://estore.onthehub.com/WebStore/OfferingDetails.aspx?o=66eb7ed2-3584-e711-80f3-000d3af41938&pmv=00000000-0000-0000-0000-000000000000>

Student Assessment

Student performance will be evaluated on the following basis:

Self-test questions (31 x 5 pts each)	155 pts
Problem Sets (10 x 10 pts each)	100 pts
Final Exam	100 pts
Total =	355 pts

Grade Calculation: A = 90-100%, B = 80-89%, C = 70-79%, D = 60-69%, F = 59% or less

Assignments

Students will complete a series of reading assignments, self-test questions and problem sets designed to reinforce concepts covered during discussion sessions. Reading assignments must be completed by the due date in preparation for discussions. Written assignments must be emailed to Dr. Richmond (drichmond@purdue.edu) as *.doc, *.docx, or *.pdf documents by the due date. All written assignment must be submitted with file names as follows:

Example 1: "Lastname_self_test_1 and 2.pdf"

Example 2: "Lastname_problem_set_1.doc"

Please include the same file name in the subject line of the email you send containing your completed assignment!

Armyworm Experiment

We will be conducting a semester-long experiment examining the effects of nitrogen fertilization on the growth and susceptibility of collard plants to the beet armyworm, *Spodoptera exigua* Hübner. Several sessions will be devoted to setting up and discussing this experiment, and collecting and organizing data. The experiment will be used to reinforce key concepts discussed in class, and the data we collect will be used for the final exam. During these sessions (highlighted in yellow on the syllabus), we will meet in SMTH B-80 (Dr. Richmond's Laboratory).

Classroom Policies

Attendance and Participation

The instructor expects students to be in attendance for all learning sessions. In order to maximize the learning experience, students should also demonstrate that they are actively engaged in the course by contributing to discussions and actively participating in projects. Students are expected to come to each session prepared. Preparation will usually require reading materials ahead of class meeting times.

Academic Honesty

To foster a climate of trust and high standards of academic achievement, Purdue University is committed to cultivating academic integrity and expects students to exhibit the highest standards of honor in their scholastic endeavors. Academic integrity is essential to the success of Purdue University's mission. As members of the academic community, our foremost interest is toward achieving noble educational goals and our foremost responsibility is to ensure that academic honesty prevails." (Purdue University Regulations, Part 5, Section II). In compliance with this policy, any instance of plagiarism, cheating, dishonesty, or the facilitation thereof will result in a grade of 0 for the assignment. If a second instance occurs, the student will be reported to the Dean of Students.

Students with Disabilities

Students with disabilities are expected to meet the same academic standards as all students in their respective programs. In some cases, however, it is necessary that they receive academic adjustments to make the educational opportunity more accessible. Academic adjustments may include, but are not limited to, alternative testing methods, copies of instructor notes, enlarged handouts, distraction-limited testing, extra time for exams, no in-class spelling penalty, note-taker in class, readers, in-class sign language interpreter, permission to tape record lectures, etc. To receive academic adjustments, a student must register with and provide documentation of his or her disabling condition to the Adaptive Programs staff of the Office of the Dean of Students." (Purdue University Policies and Procedures, on-line handbook).

Diversity and Inclusiveness

As the instructor of this course, I am firmly committed to the idea that each voice in the classroom has something of value to contribute. Please take care to respect the different experiences, beliefs, and values expressed by students and staff involved in this course. I support Purdue's commitment to diversity, and welcome individuals of all ages, backgrounds, citizenships, disabilities, sex, education, ethnicities, family statuses, genders, gender identities, geographical locations, languages, military experience, political views, races, religions, sexual orientations, socioeconomic statuses, and work experiences.

Sexual Misconduct (Title IX)

In the event that you choose to write or speak about having survived sexualized violence, including rape, sexual assault, dating violence, domestic violence, or stalking, Purdue policies require that, as your instructor, I share this information with Erin Oliver, Purdue's Title IX Coordinator. Erin or her trusted colleagues will contact you to let you know about accommodations and support services at Purdue as well as options for holding accountable the person who harmed or threatened you. **You are not required to speak with them.**

If you do not want the Title IX Coordinator notified, instead of disclosing this information to me, you can speak confidentially with the following people on campus and in the community. They can connect you with support services and help explore your options now, or in the future.

- **Center for Advocacy, Response and Education (CARE), available 24/7:** (765) 495-CARE (2273).
- **Counseling and Psychological Services (CAPS), available 24/7:** (765) 494-6995
- **Student Health (PUSH):** (765) 494-1700
- **MHA Crisis Center, available 24/7:** (765) 742-0244

If you are a survivor or someone concerned about a survivor and need immediate information on what to do, please go to https://www.purdue.edu/sexual_assault/index.html.

Campus Emergencies

In the event of a campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Here are ways to get information about changes in this course:

Instructor's email: dritchmond@purdue.edu

Instructor's telephone: 765-494-0399

Course blackboard site:

https://mycourses.purdue.edu/webapps/blackboard/content/listContent.jsp?course_id=364774_1&content_id=10810734_1

Specific Actions Will Be Taken in Case of an Emergency

- If we hear a **fire alarm**, we will immediately suspend class, **evacuate the building**, and proceed outdoors, and away from the building. **Do not use the elevator**
- If we are notified of a **Shelter in Place requirement for a tornado warning**, we will suspend class and **shelter in the lowest level of this building** away from windows and doors
- If we are notified of a **Shelter in Place requirement for a hazardous materials release, or a civil disturbance, including a shooting or other use of weapons**, we will suspend class and **shelter in our classroom, shutting any open doors or windows, locking or securing the door, and turning off the lights**

Class Schedule:

Date	Topic	Assignments	Due Date*
8/20	Course introduction & goals The importance of good experimental design	Reading: Ruxton & Colegrave Chapters 1&2 Self-test questions: 1.1, 1.2, 1.4 & 2.1, 2.2, 2.5	8/27
8/22	Armyworm experiment: Initiation	MEET IN SMTH B-80	
8/27	It all starts with a hypothesis	Reading: Ruxton & Colegrave Chapter 3 Self-test questions: 3.1-3.2	8/29
8/29	The broad outlines of a study	Reading: Ruxton & Colegrave Chapter 4 Self-test questions: 4.1-4.3	9/3
9/3	Variation, replication & sampling	Reading: Ruxton & Colegrave Chapter 5 Self-test questions: 5.1-5.3	9/5
9/5	Pseudoreplication	Reading: Ruxton & Colegrave Chapter 6 Self-test questions: 6.1, 6.3, 6.5	9/12
9/10	Armyworm experiment: Data collection I	MEET IN SMTH B-80	
9/12	Sample size, power and efficiency	Reading: Ruxton & Colegrave Chapter 7 Self-test questions: 7.1-7.3	9/17
9/17	Single factor designs	Reading: Ruxton & Colegrave Chapter 8 Self-test questions: 8.1-8.3	9/19
9/19	Factorial designs	Reading: Ruxton & Colegrave Chapter 9 Self-test questions: 9.1-9.2	9/24
9/24	Blocking and covariates	Reading: Ruxton & Colegrave Chapter 10 Self-test questions: 10.1-10.2	10/1
9/26	Armyworm experiment: Data collection II	MEET IN SMTH B-80	
10/1	Within subject designs	Reading: Ruxton & Colegrave Chapter 11 Self-test questions: 11.1, 11.3, 11.4, 11.5	10/3
10/3	Taking measurements	Reading: Scheiner & Gurevitch pgs. 3-11	10/10
10/8	OCTOBER BREAK – NO CLASS		
10/10	Theories, hypotheses & statistics	Reading: Scheiner & Gurevitch pgs. 14-18	10/15
10/15	Exploratory data analysis and graphic display	Problem Set 1	10/22
10/17	Armyworm experiment: Data collection III	MEET IN SMTH B-80	
10/22	Linear regression	Problem Set 2	10/29
10/24	Armyworm experiment: Data Collection IV	MEET IN SMTH B-80	
10/29	Polynomial regression	Problem Set 3	10/31
10/31	Multiple regression	Problem Set 4	11/7
11/5	Armyworm experiment: Data collection VI	MEET IN SMTH B-80	
11/7	Non-linear regression	Problem Set 5	11/12
11/12	Single factor ANOVA	Problem Set 6	11/14
11/14	Two factor ANOVA	Problem Set 7	11/26
11/19	ESA ST. LOUIS – NO CLASS		
11/21	ESA ST. LOUIS – NO CLASS		
11/26	Hierarchical designs, error structure, fixed & random effects	Problem Set 8	12/3
11/28	THANKSGIVING BREAK – NO CLASS		
12/3	Repeated-measures ANOVA	Problem Set 9	12/5
12/5	ANCOVA – Homogeneity of slopes and separate slopes models	Problem Set 10	12/9
Final Exam		TBA	12/13

*Assignments are due at 12:00 noon on the prescribed due date