Fall, 2022

Stat 313 – Applied Experimental Design and Regression Models

Instructor: Beth Chance
Class Time: Sec 1: 3:10-4pm, Room 180-272
Sec 1: 4:10-5pm, Room 180-272
Office: Faculty Office Building East 25-235
Phone: 756-2961 (×62961 on campus)
Email: bchance@calpoly.edu   (a very good way to reach me)
Office Hours: M 7-8pm, T 1:30-2:30pm, W 10:30-11:30am, R 1:30-2:30pm, F 9-10am, or
by appointment, and by appointment, email, and anytime my office door is
open. See also a Zoom appointment link in Canvas.
Course Webpages: Canvas (http://my.calpoly.edu), Lecture notes
Course Listserv: stat-313-01-2228@calpoly.edu; stat-313-02-2228@calpoly.edu
Discord server: https://discord.gg/WvR3FDQMuw

Pre-requisite: Successful completion of STAT 217, 218, 221, or 312 (or equivalent)

Course Objectives:
- Identify and quantify sources of variation in a response variable
- How to adjust for potential confounding variables through design and/or analysis
- Distinguish several common experimental designs include one-way classification, randomized blocks, two-factor and three-factor completely randomized designs
  - Including post-hoc comparisons of population means
- Understand basics of simple linear and multiple regression including Residual analysis, Lack of Fit, Transformations, Tests for normality, Indicator variables and Effect coding

Texts/Materials:
Required:
- *Intermediate Statistical Investigations*, Tintle, Chance, McGaughey, Roy, Swanson, and VanderStoep (2021)
  - *You should purchase the "eBook" or WileyPlus*
- Additional course notes supplied by the instructor

Optional:
- *Stat 2: Building Models for a World of Data*, Cannon et al. (2013), Freeman
- *The Statistical Sleuth*, Ramsey and Schafer (2013), Cengage
- *Modern Statistics for the Life Sciences,* Grafen and Hails (2002), Oxford Univ Press

You will be expected to have access to the book/other online materials during class. You will also be provided with additional course handouts. You are encouraged to keep these together in a three-ring binder. You should also have a scientific calculator. You will need out-of-class access to **JMP or R** statistical packages, as well as some applets. PowerPoint slides and handouts from previous lectures will be available on the course web pages.

Grading:

Lab Assignments/Quizzes	15%	Homework assignments	10%
Project	15%	Exams 15%, 20%, 25% (final)	

Coursework:

- You are expected to read the relevant section in the textbook (and/or watch videos) each night to prepare for the next class period. This will be followed by
  - Mondays/Wednesdays: A short readiness quiz at the beginning of class (so be on time). These will be graded mostly on participation and you can miss 2 without penalty. These quizzes will be very similar to the optional reading quizzes.
  - Tuesday/Thursdays: A lab assignment to be completed with a randomly assigned partner by the end of class (usually). You will submit written answers as a pair, based on the reading assignment and questions in class. (These generally follow the "explorations" in the text.
- *Homework assignments* will be assigned roughly weekly and will apply the methods and concepts learned in class. You may work with a partner and submit one assignment with both names. You are expected to work on HW (and ask questions) throughout the week. Saving the assignment until the night before will not allow you enough time.
- There will be two *exams* and a comprehensive final. You will be allowed 1-3 pages of notes. Graded exams will be returned in class or can be picked up from the instructor. You may be asked to analyze data on the computer.
- There will be a *data analysis project*. You may work in groups of 1-3. The purpose of the project is to give you an opportunity to apply what you have learned in this class to your own discipline, including planning a study, collecting data, and analyzing data. Reports will be graded on quality of statistical analysis as well as presentation of results and appropriateness of interpretations and conclusions. You should anticipate being asked to give an oral presentation at the end of the course.

Advice:
1. Come to class.
2. Participate in class.
3. Work together.
4. Ask questions.
5. Review your notes often.
6. Check the course webpage and email list regularly.
7. Start the assignments early.
8. Take the course seriously.
9. Have fun with the material.
10. Think!

Above all, you are responsible for your own learning. As your instructor, my role is providing you with contexts and opportunities to facilitate the learning process. Please call on me to help you with this learning in whatever ways I can.

Academic Integrity
The University Code of Academic Integrity is central to the ideals that undergird this course. Students are expected to be independently familiar with the Code and to recognize that their work in the course is to be their own original work that truthfully represents the time and effort applied. Violations of the Code are most serious and will be handled in a manner that fully represents the extent of the Code and that befits the seriousness of its violation. You and your student peers must have a strong commitment to personal and professional integrity that informs your behavior both before and after graduation, discouraging you from creating a false appearance of achievement by presenting the work of others as your own, or bending or breaking the rules of any situation. This includes the unauthorized use and sharing of information/course resources on the internet.

COVID-19 Compliance, Classroom, and Campus Safety
Cal Poly is committed to protecting the health and safety of the campus community. Taking preventative steps, as well as monitoring your health and staying home if you are feeling unwell, will help protect the entire Cal Poly community. By participating in this course, you agree to abide by all campus safety protocols. Please note that safety protocols may change throughout the quarter. This includes always properly wearing a face covering in the classroom, regardless of vaccination status. You may also wish to bring in your own device for computer work.

Support
If you face emotional or economic challenges this quarter, you are not alone, and Cal Poly can help during this time of crisis. For example:
- Cal Poly's Basic Needs initiative: basicneeds.calpoly.edu
- Student Care Resources: https://coronavirus.calpoly.edu/student-care-resources
- Cal Poly Coronavirus website: http://coronavirus.calpoly.edu/
- Disability Resource Center: drc@calpoly.edu
- Cal Poly's Counseling Services (805-756-2511)

If I can help you in any way to access the resources above, or if you have any questions about student care resources, please let me know, including textbook access.

Responsibilities
Through classroom discussion and online communication, I welcome individuals of all ages, backgrounds, beliefs, races, ethnicities, social classes, genders, gender identities, gender expressions, national origins, documentation statuses, religious affiliations, sexual orientations, abilities – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful and inclusive environment for every other member of the class. This does not mean we cannot disagree or have different ideas. It does mean we try to consider perspectives other than our own, though they may differ from our own beliefs/experiences. If you experience disrespect or discrimination in this class, please report your experiences to me or the Statistics Department chair (aschaffn@calpoly.edu).

Tentative Schedule

	Day	Date	Ex	Topic	Due
1	M	9/19	P.A	Case study (wages) (Lab 1)	
2	T	9/20	P.B	Prediction	Lab 1
3	W	9/21	1.1	Explaining variation (Lab 2)	
4	R	9/22	1.2	Quantifying sources of variation	Lab 2
5	M	9/26	1.3	Statistical significance (Lab 3)	HW 1
6	T	9/27	1.4	Comparing multiple groups	Lab 3
7	W	9/28	1.5	Estimation (Lab 4)	
8	R	9/29	1.6	Power	Lab 4
9	M	10/3			HW 2
10	T	10/4	2.1	Paired data (Lab 5)	Lab 5
11	W	10/5	2.2	Block designs	
12	R	10/6	3.1	Multi-factor experiments	Lab 6
13	M	10/10		**Review**	HW 3
14	T	10/11		**Exam 1**	
15	W	10/12	2.3	Observational studies	
16	R	10/13		Cont.	
17	M	10/17	3.2	Interactions	Project Proposal
18	T	10/18	3.3	Replication	Lab 7
19	W	10/19	3.4	Interactions: observational studies	
20	R	10/20		Cont.	Lab 8
21	M	10/24	4.1	Simple linear regression	HW 4
22	T	10/25	4.2	Inference for regression	Lab 9
23	W	10/26	4.3	Indicator variables	
24	R	10/27	4.4	Interactions	Lab 10
25	M	10/31	4.5	Multi-category variables	HW 5
26	T	11/1		Case study	Lab 11
27	W	11/2		**Review**	
28	R	11/3		**Exam 2**	
29	M	11/7			Project Report 2
30	T	11/8	5.1	Response surfaces	Lab 12
31	W	11/9	5.2	Observational studies	
32	R	11/10	5.3	Nonlinear associations: Polynomial	Lab 13
33	M	11/14	5.4	Nonlinear associations: Transform	HW 6
34	T	11/15	6.1	Categorical response variables	Lab 14
35	W	11/16	6.2	Logistic Regression	
36	R	11/17	6.3	Multiple logistic regression	Lab 15
		11/21		**Happy Thanksgiving!**	
37	M	11/28		Presentations	HW 7
38	T	11/29		Presentations	
39	W	11/30		Presentations	
40	R	12/1		Review	Final Reports
Final Exams: Sec 1: Monday 1-4pm Sec 2: Wednesday 4:10-7pm					