BMEN 4980 –Experimental Design and Data Analysis

Course Syllabus

Fall 2022

Instructor: Dr. Brian Meckes
Office: K240D
Office Hours: W 11-12 PM; Or by appointment (in-person or Zoom)
Class: TR 2:30-3:50
Email: brian.meckes@unt.edu

Course Description: An advanced course in the design of experiments and analysis of biological data sets. This course will cover topics that include advanced hypothesis testing, non-parametric models, and power analysis for experimental design. Software tools for interpreting and visualizing data will be covered.

References (Required):

Biostatistics with R: An Introduction to Statistics Through Biological Data by Shahbaba (freely available digitally through the university library)
Experimental Design and Data Analysis for Biologists by Quinn/Keough
R in Action by Rob Kabacoff
r-bloggers.com

Prerequisites: None

Course Objectives:

1. To provide a fundamental understand of how to design experiments to achieve statistically meaningful results.
2. To develop the skills to implement computational tools for data analysis across diverse data sets.
3. To develop a practical framework for understanding data analysis

Grading Policies:

Grade Breakdown

Area	% Grade
Homework	50%
Midterm	20%
Project	10%
Final	20%

COVID-19 Impact on Attendance

While attendance is expected as outlined above, it is important for all of us to be mindful of the health and safety of everyone in our community, especially given concerns about COVID-19. Please contact me if you are unable to attend class because you are ill, or unable to attend class due to a related issue regarding COVID-19. It is important that you communicate with me prior to being absent so I may make a decision about accommodating your request to be excused from class.

If you are experiencing any symptoms of COVID-19 (https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html) please seek medical attention from the Student Health and Wellness Center (940-565-2333 or askSHWC@unt.edu) or your health care provider PRIOR to coming to campus. UNT also requires you to contact the UNT COVID Hotline at 844-366-5892 or COVID@unt.edu for guidance on actions to take due to symptoms, pending or positive test results, or potential exposure. While attendance is an important part of succeeding in this class, your own health, and those of others in the community, is more important.

Class Materials for Remote Instruction

Remote instruction may be necessary if community health conditions change or you need to self-isolate or quarantine due to COVID-19. Students will need access to a [webcam and microphone – faculty member to include what other basic equipment is needed] to participate in fully remote portions of the class. Additional required classroom materials for remote learning include: [list specific software, supplies, equipment or system requirements needed for the course]. Information on how to be successful in a remote learning environment can be found at https://online.unt.edu/learn

Attendance Policy

Attendance for classes is required.

Homework and Quizzes:

Homework will be given typically every other week. Quizzes will be held periodically (on Canvas during class time). Homework will only be accepted via Canvas. Please use appropriate apps for scanning and submitting as a PDF. Smartphone photos will not be accepted. It is the student's responsibility to ensure that the material is legible. Apps that may be appropriate if you do not have a scanner (typed versions are always welcome too) include: Adobe Scan (free and highly dependable), Microsoft Office Lens, or Tiny Scanner.

Grade Evaluations:

A – 90-100%
B – 80-89%
C – 70-79%
D – 60-69%
F - < 60%
This scale may be lowered at the instructor's discretion (but not raised).

Disability Policy: The University of North Texas does not discriminate on the basis of an individual's disability and complies with Section 504 and Public Law 101-336 (Americans with Disabilities Act) in its admissions, accessibility, treatment, and employment of individuals in its programs and activities. A copy of the College of Engineering ADA Compliance Document is

available in the Dean's Office. It is the responsibility of the student to inform the instructor of any disabling condition that will require modifications by the 12th class day. All reasonable accommodation will be made to facilitate special needs. Office of Disability Accommodation (ODA), Union Suite 322, (940) 565-4323. http://www.unt.edu/oda.

Late Work: Late work is accepted up 3 days after the deadline. You lose 10% of the available points for each day late. After 3 days, you will receive a zero. All late work may not receive complete feedback and only a score may be available.

Examination Policy: All exams are in person. You may utilize a single sheet of paper (front and back) with notes. Cell phones must be put away. Only pens, paper, and calculators may be on your desk. Any student found to have a cell phone on their desk during exam time will receive a zero.

Americans with Disabilities Act: The University of North Texas does not discriminate on the basis of an individual's disability and complies with Section 504 and Public Law 101-336 (Americans with Disabilities Act) in its admissions, accessibility, treatment, and employment of individuals in its programs and activities. A copy of the College of Engineering ADA Compliance Document is available in the Dean's Office. *It is the responsibility of the student to inform the instructor of any disabling condition that will require modifications by the 12th class day.*

Schedule of classes (subject to change):

#	Date	Day	Topic Covered	Reading
1	Aug 30	T	Intro to Analysis and R	Appendix A Shahbaba
2	Sep 1	R	Basics of using R	Appendix B Shahbaba
3	Sep 6	T	Introduction to Descriptive Statistics	2.1-2.3 Shahbaba; 2 Quinn
4	Sep 8	R	Visulization of Data Using R	2.4-3 Shahbaba; 4 Quinn
5	Sep 13	T	Estimation	6 Shahbaba
6	Sep 15	R	Hypothesis Testing	3.1-3.7 Quinn, 7.1-7.3 Shababab
7	Sep 20	T	T Tests	7.4 Shahbaba
8	Sep 22	R	ANOVA (1 dimensional)	8 Quinn, 9.1-9.3 Shababa
9	Sep 27	T	ANOVA Multi-Dimensional	9 Quinn, 9.4 Shahbaba
10	Sep 29	R	Non-Parametric Hypothesis Testing	
11	Oct 4	T	Study Design	7 Quinn
12	Oct 6	R	Power Analysis: what it is and how we use it	7 Quinn
13	Oct 11	T	Power Analysis in R	10 Manning
14	Oct 13	R	**Review**	
15	Oct 18	T	**Midterm**	
16	Oct 20	R	Regression Analysis	13 Quinn; 11 Shababa
17	Oct 25	T	Linear Regression Analysis	13 Quinn; 11 Shababa
18	Oct 27	R	Polynomial Regression	
19	Nov 1	T	Logistic Regression	13.2 Quinn
20	Nov 3	R	Generalized Curve Fitting	Notes: Brian

21	Nov 8	T	Multivariate Analysis	15 Quinn
22	Nov 9	R	ANCOVA	12 Quinn; https://www.r-bloggers.com/2021/07/how-to-perform-ancova-in-r/
23	Nov 15	T	MANOVA	16 Quinn; https://www.r-bloggers.com/2022/01/manova-in-r-how-to-implement-and-interpret-one-way-manova/
24	Nov 17	R	Principle Component Analysis	17 Quinn
25	Nov 22	T	Clustering	12 Shababa; 16 Manning
26	Nov 29	T	Clustering Applications	
27	Dec 1	R	Classification	17 Manning
28	Dec 6	T	Classification Applications	
29	Dec 8	R	**REVIEW**	
30	Dec 13	T	**Final Exam starting at 1:30**	