BMEN 5007/4007

Course Syllabus

Fall 2024

Instructor: Dr. Brian Meckes
Office: K240D
Office Hours: R 11-12 PM; Or by appointment (in-person or Zoom)
Class: TR 2:30-3:50; B155
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

ABET Outcomes

ABET Outcome 7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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	25%
Final	25%

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.

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.***

Student Conduct: Every student in this class should have the right to learn and engage within an environment of respect and courtesy from others. We will discuss our classroom's habits of engagement and I also encourage you to review UNT's student code of conduct so that we can all start with the same baseline civility understanding (Code of Student Conduct) (https://policy.unt.edu/policy/07-012).

Academic Honesty: Every student in my class can improve by doing their own work and trying their hardest with access to appropriate resources. Students who use other people's work without citations will be violating UNT's Academic Integrity Policy. Please read and follow this important set of guidelines for your academic success (https://policy.unt.edu/policy/06-003). If you have questions about this, or any UNT policy, please email me or come discuss this with me during my office hours.

Schedule of classes (subject to change):

#	Date	Day	Topic Covered	Reading
1	Aug 20	T	Intro to Analysis and R	Appendix A Shahbaba
2	Aug 22	R	**No In Person Class;** Basics of using R	Appendix B Shahbaba
3	Aug 27	T	Introduction to Descriptive Statistics	2.1-2.3 Shahbaba; 2 Quinn
4	Aug 29	R	Visulization of Data Using R	2.4-3 Shahbaba; 4 Quinn
5	Sep 3	T	Estimation	6 Shahbaba
6	Sep 5	R	Hypothesis Testing	3.1-3.7 Quinn, 7.1-7.3 Shababab
7	Sep 10	T	Correlation	7.4 Shahbaba
8	Sep 12	R	T Tests	7.4 Shahbaba
9	Sep 17	T	ANOVA (1 dimensional)	8 Quinn, 9.1-9.3 Shababa
10	Sep 19	R	ANOVA Multi-Dimensional	9 Quinn, 9.4 Shahbaba
11	Sep 24	T	Non-Parametric Hypothesis Testing	
12	Sep 26	R	Resampling Methods	12 Kabacoff
13	Oct 1	T	Power Analysis	10 Kabacoff
14	Oct 3	R	Regression Analysis	13 Quinn; 11 Shababa
15	Oct 8	T	**REVIEW**	
16	Oct 10	R	**Midterm**	
17	Oct 15	T	Linear Regression Analysis	13 Quinn; 11 Shababa
18	Oct 17	R	Logistic Regression	13.2 Quinn
19	Oct 22	T	**No Class**	**BMES**
20	Oct 24	R	Generalized Curve Fitting	Notes: Dr. Meckes
21	Oct 29	T	Multivariate Analysis	15 Quinn
22	Oct 31	R	ANCOVA	12 Quinn; https://www.r-bloggers.com/2021/07/how-to-perform-ancova-in-r/
23	Nov 3	T	MANOVA	16 Quinn; https://www.r-bloggers.com/2022/01/manova-in-r-how-to-implement-and-interpret-one-way-manova/
24	Nov 7	R	Factor Analysis	
25	Nov 9	T	Principle Component Analysis	17 Quinn
26	Nov 12	R	Clustering	12 Shababa; 16 Kabacoff
27	Nov 14	T	Clustering Applications	
28	Nov 19	T	Classification Decision Trees	17 Kabacoff
29	Nov 21	R	**Catch up/special topic; no in person class**	
30	Dec 3	T	Classification Random Forest	
31	Dec 5	R	**REVIEW**	
32	Dec 10	T	**Final Exam starting at 1:30-3:30**	