STATISTICAL TECHNIQUES FOR THE BIOMEDICAL SCIENCES
BMR 617
SPRING 2022

SYLLABUS

Course Director:
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Other Course Instructor:
Andrew Nato, Ph.D.
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Required Text:
There is no required text for this course. Online teaching materials will be provided by the instructors.

Class Policy:
This is a 3 credit hour course. Classes will take place on Mondays, Wednesdays and Fridays from 10:00-10:50am by video conference.

Course Content:
This course is an application-oriented course in statistical concepts and techniques aimed at prospective researchers in biomedical sciences. Discussion of the underlying statistical theory will be limited to contexts in which this enhances the intuitive understanding.
Class time will include presentations by students on the sections covered in the previous week, with discussion from other class attendees and the instructor, as well as material presented by the instructor.
Students will use the statistical environment R for hands-on work; additional resources will be given and presented in class for using R.

Objectives and Outcomes:
Upon successful completion of this course, students will be able to:

- Formulate a data analysis plan as part of an experimental design in biomedical sciences

- Be able to present data in a form suitable for publication in peer reviewed journals and in a manner which is accessible to the reader
- Understand the role and uses of statistical modeling in biomedical research
- Critically read data analysis presentations and methodological descriptions in biomedical research journals
- Perform day-to-day statistical analyses required of a biomedical science researcher
- Understand and use a sufficient level of statistical jargon to communicate with experts in the field of statistics when more sophisticated analyses are required
- Select and perform appropriate statistical tests for hypothesis testing
- Understand the extent to which deviations from statistical and mathematical ideals occur in real-world biomedical research and discuss the extent to which these may be tolerated.

Grading, Assessment and Examinations:

Grades will be assigned on a standard percentage scale:

A	At least 90%
B	At least 80% and less than 90%
C	At least 70% and less than 80%
D	At least 60% and less than 70%
F	Less than 60%

Percentages will be based on performance in three take-home exams, one comprehensive take-home final exam, and class participation and assignments during the semester. Overall percentages will be computed as follows:

Exam 1	15%
Exam 2	15%
Exam 3	15%
Class participation and assignments	15%
Final Exam	40%

All exams may contain any of essay questions, short answer questions, or multiple-choice questions.

Only under exceptional circumstances will a student be permitted to submit an exam at a time later than the scheduled time. Exceptional circumstances include: death or serious illness in the immediate family, childbirth, illness requiring hospitalization and illness serious enough to warrant a written dispensation from a physician. Minor illnesses are **NOT** exceptional circumstances. A written doctor's excuse stating the nature of the illness will be required. In the event of any exceptional circumstances, students must make every possible attempt to contact the instructor before the scheduled exam. If arrangements have not been made beforehand, the student **MUST** contact the course director within 24 hours after the scheduled exam period to discuss rescheduling the exam.

Course Schedule:
The exam dates in this schedule are fixed, but the exact timing of the material may vary according to the interests and needs of the class. Exams 1, 2, and 3 will be on the material covered since the previous exam (or the beginning of the course in the case of exam 1); the final exam will be comprehensive and will be on all material covered in the course.

Week	Monday class	Wednesday class	Friday class
1: 1/10-1/14	Intro	Introduction to R and RStudio	Types of variable
2: 1/17-2/21	No class (MLK Day)	Examining distributions	The normal distribution
3: 1/24-1/28	Presenting data: one variable categorical data	Presenting data: one variable quantitative data	Presenting data: two variables C/C
4: 1/31-2/4	Presenting data: two variables Q/Q	Presenting data: two variables C/Q	Review
5: 2/7-2/11	Exam 1	Probability: Random Variables	Sampling distributions
6: 2/14-2/18	Point estimation and estimation of population mean	Confidence intervals	Estimation of population proportion
7: 2/21-2/25	Hypothesis testing	Hypothesis testing for population proportion	Inference: Chi-squared and Fisher exact tests
8: 2/28-3/4	Hypothesis testing for population mean	Inference: two-class t-test	Inference: matched pairs t-test
9: 3/7-3/11	Review		Exam 2
3/14-3/18	Spring Break		
10: 3/21-3/25	Inference: Two-way ANOVA	Two-way ANOVA post-hoc tests	Interactions
11: 3/28-4/1	Inference: linear regression	Linear models	Multiple linear regression
12: 4/4-4/8	Sample size and power analyses	Review	
13: 4/11-4/15	Exam 3	Intro to bioinformatics	
14: 4/18-4/22	Multiple hypothesis testing	Review	
4/25-4/29	Exam week		

Exam **due** dates:
Exam 1: February 11th
Exam 2: March 16th
Exam 3: April 15th
Final Exam: April 29th