ECE 608: QUANTITATIVE METHODS IN BIOMEDICAL ENGINEERING
Spring 2022

Course Description and Aims
This biomedical engineering core course aims to equip students with the practical quantitative methods to analyze and solve biomedical problems. The concepts of hypothesis testing, statistical analysis, and experimental design strategies will be introduced. One major focus of this course is to familiarize students with the statistical programming language R and various statistical tools such as t-test, ANOVA, and regressions. This course also aims to demonstrate how these tools can be appropriately applied to analyze biomedical datasets quantitatively and, in turn, draw conclusions that are justified with numbers.

Teaching Staff
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Reference Materials
- S. Kuiper and J. Sklar, *Practicing Statistics: Guided Investigations for the Second Course*. Boston: Pearson Education Inc., 2013. ISBN 0-321-58601-8.

- G. Grolemund and H. Wickham. *R for Data Science*. O'Reilly Media, 2017. [Available online, free, at r4ds.had.co.nz]

Course Learning Outcomes

By the end of this course, students should be able to demonstrate a threshold level of mastery of the following learning outcomes:

1. Form a hypothesis in a biomedical problem and design experiments to collect data

2. Conduct appropriate statistical analyses on data using **R** to test hypotheses

3. Interpret and present statistical results scientifically

Course Teaching and Learning Activities
This course will be taught in in-person lecturing format. There will be two classes every week, to be held on Mondays and Fridays (10am to 11:20am Eastern time). The tentative course contents for each week are listed below.

May 2 & 6:	Basic concepts of quantitative methods
May 9 & 13:	Parametric test: assumptions and comparison of means
May 16, 20 & 27:	One-way analysis of variance (ANOVA) and post-hoc test
May 30, June 3 & 6:	Repeated measures one-way ANOVA and factorial ANOVA
June 10:	Sample size and statistical power
June 13:	Mid-Term
June 17 & 20:	Correlation and simple linear regression
June 24, 27 & Jul 4:	Multiple linear regression and assumption checking
July 8 & 11:	Logistic regression
July 15 & 18:	Sensitivity, specificity and receiver operating characteristics
July 22:	Reliability and validity

July 25 & 26:   Survival rate and Hazard ratio

Grade Breakdown

Online quiz on LEARN   10%
- Multiple choice questions revisiting the concepts covered in-class
- Due dates: May 20, June 10, July 2, July 22

Problem sets $\times$ 2   20%
- Three problem sets to help you practice the statistical methods covered in-class
- Due dates: June 17, and July 29

Mid-term quiz   20%
- Combination of true-or-false questions, multiple choice questions, and statistical analysis questions

Final exam   50%
- Combination of true-or-false questions, multiple choice questions, and statistical analysis questions