MTH 412/512 **Intro to Statistical Inference**
Spring 2024

Instructor: Brian Spencer
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Lectures: Tue/Thu 2:00-3:30
Recitation (412 only): Fri 12:00-12:50

Course Information: Statistics for advanced undergraduate / beginning graduate students in mathematics, science and engineering who have had a one-semester course in probability. The course emphasizes development of rigorous proofs of statistical results, understanding of the limitations of statistical analysis, usage of statistical packages written in *R*, and analysis of real-world data from case studies.

Prerequisite: MTH 411/511

Catalog Description: Rigorous derivation of statistical results, clarification of limitations of statistical analysis, extensive use of computational software, application of statistical methods to case studies. Topics include: Graphical and numerical techniques for exploring data. Use and accuracy of population samples using parametric and nonparametric methods. Determination of probability distributions from statistical data. Use of computational methods based on resampling of data to determine reliability of statistical information. Classical statistical inference methods: probability distribution estimation, confidence intervals for statistical results, hypothesis testing for statistical significance. Fitting of data using linear regression and determining the accuracy of fit. Bayesian methods for estimating probability distributions using prior information.

Text: *Mathematical Statistics with Resampling and R, by Laura Chihara and Tim Hesterberg (edition to be determined)*.

Coursework: Exercises (not collected, answers given), homework (collected and graded), three exams. About 1/2 of the topics and assignments will involve some usage of computational software written in *R*. Exams do not test coding in *R*.

Coding in R: The programming language *R* will be used to illustrate computation-based methods from class. Prior experience with *R* is not necessary. The programs will be written and executed within a *Jupyter Notebook* environment in which the code, text descriptions and output appear in a single document. Students will be required to use *R* for some assignments. Example code for calculations will be presented in lecture, with a copy of the program available for download via UBLearns. Instructions for installing the necessary (free) software *Anaconda3 / Jupyter Notebook* and setting it up to run programs in *R* will be posted on UBLearns during the first week of class.