

MATH 4740/MSSC 5740 – Biostatistical Methods and Models

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Office Hours: 12:15 – 1:45 PM, Tuesday and Thursday, and by appointment

Course Description:

Introduction to the statistics of life science and the use of mathematical models in biology. Data analysis and presentation, regression, analysis of variance, correlation, parameter estimation and curve fitting. Biological sequence analysis, discrete and continuous mathematical models and simulation. Credit is not given for both MATH 4720 and MATH 4740.

Prerequisite: MATH 1400, MATH 1410 or MATH 1450.

Course Learning Objectives:

Students will learn all basic tools of analyzing biostatistical data with fundamentals of testing hypotheses, regression analysis, analysis of variance, and nonparametric inference. About one fourth of the course will be devoted to probability tools for the purpose of biostatistical data analyses. A basis introduction of Bayes rule, sensitivity and specificity, and ROC curve will also be given. Primary focus will on biomedical data and its analyses throughout the course. Students may also become familiarity with the R statistical software.

Discovery Tier:

This course belongs to the Expanding Horizons Discovery Tier*. Courses in this theme focus on how the process of discovery--through art, scientific research, and other modes of seeking answers to fundamental questions--expands our understanding of the value of life and enriches our interaction with our communities, the planet, and the universe.

Statistical methods are essential in building up evidence for and supporting new knowledge by seeking scientific truths with data. In this course, information contained within data is described with charts, graphs, and parameter point estimates. In addition, parameter interval estimates are formed to enclose scientific values and hypotheses tested to confirm or refute claimed scientific values. The course will be aimed toward young independent thinkers wishing to utilize scientific statistical methods aimed toward discovering truth.

During the first lecture the guiding topic of “How do we discover new knowledge from biomedical data.” will be introduced. This topic will be a major theme throughout the course while statistical methods to uncover and confirm biomedical knowledge are presented. Course assignments will be reflective of the scientific discovery within biomedical data. The final lecture will review and conclude the biomedical data discovery journey.

* This class recently added to MCC-Expanding Horizons NSM.

Textbook:

Essentials of Biostatistics in Public Health. Author: Lisa M. Sullivan, Publisher: Jones & Bartlett Learning, 4th Edition

Methods of Evaluations:

Student’s performance will be evaluated based on homework, mid-term exams, the final exam, class participation, and projects.

Exams:

Exam 1: Tuesday, February 13, 2025. Chapters 3-5.5
Exam 2: Tuesday, March 27, 2025, Chapters 5.6-7
Final: Wednesday May 7, 2025, Chapters 9-11

Homework:

Homework will be given generally after completing each chapter (due dates will be announced in the class). **Note that the best way you can prepare yourself for the course is by working on the homework problems. So, do the problems independently.**

Grading Policy:

Mid-Term Exam 1: 25 %
Mid-Term Exam 2: 25 %
Homework: 15 %
Class Attendance: 5 %
Final Exam: 30 %

MATH 4740 Scale:

92% - 100% (A) 88% - 92% (A-)
86% - 88% (B+) 80% - 86% (B) 78% - 80% (B-)
76% - 78% (C+) 70% - 76% (C) 68% - 70% (C-)
66% - 68% (D+) 60% - 66% (D) 56% - 60% (D-)
0% - 56% (F)

MSSC 5740: Students in MSSC 5740 will be expected to demonstrate mastery of additional homework assignments, exam questions, and/or projects.

MSSC 5740 Scale:

92% - 100% (A) 88% - 92% (A-)
86% - 88% (B+) 80% - 86% (B) 78% - 80% (B-)
76% - 78% (C+) 70% - 76% (C) 0% - 70% (F)

Note:

There will not be any make-up exam, or homework unless there is an emergency.

Topics:

- 0) Introductions & Syllabus
- 1) Chapter 3 Quantifying the Extent of Disease
- 2) Chapter 4 Summarizing Data Collected in the Sample
- 3) Chapter 5 The Role of Probability
- 4) Chapter 6 Confidence Interval Estimates
- 5) Chapter 7 Hypothesis Testing Procedures
- 6) Chapter 9 Multivariable Models
- 7) Chapter 10 Nonparametric Tests
- 8) Chapter 11 Survival Analysis

Computer Usage:

A statistical package may be introduced early and discussed throughout the course to supplement the lectures. The purpose of the statistical package is for students to familiarize themselves with the use of statistical software in statistical analyses.