

MATH 4/5530 Statistical Computing

Class No. 6962/6970 - 100
Spring 2021-2022

Class homepage: All class materials available at the Blackboard (please check back often!)
Time: MWF 3:05-4:00 PM, 314 Morton Hall
Instructor: Annie X. Shen
Office: 571 Morton Hall
Office Hours: Wednesday and Friday, 2:00-3:00 pm, or by appointments
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Catalog Description.

Introduction to computational statistics; Monte Carlo methods, bootstrap, data partitioning methods, EM algorithm, probability density estimation, Markov Chain Monte Carlo methods.

Prerequisite. MATH 4/5500 or equivalent (Please see the instructor if students who do not meet prerequisite)

The course aims to introduce elementary methods/algorithms in computational statistics using the data analysis program language R. It emphasizes implementation rather than theory. Because it is computational in nature, basic knowledge and working experiences of computer are essential.

Learning outcomes: Students will learn the core of ideas/mathematical background/algorithms of computing intensive statistical methods, write codes/use R building in functions and R-packages to assist in numerical and graphical statistical modeling.

Textbooks: All books are electronically available at Alden Library

1. [Basic Elements of Computational Statistics \(Statistics and Computing\)](#), W. K. Härdle, O. Okhrin, and Y. Okhrin, Springer 2017. ISBN-13: 978-3319553351
2. [Statistical computing with R](#), M. L. Rizzo, CRC Press, 2015.

Software

1. The R project page, <https://www.r-project.org/>,
R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS.
The R Studio, integrated development environment (IDE) for R
<https://www.rstudio.com/products/rstudio/download/>
2. Updated codes/data for textbook by Hardle is available at <http://www.quantlet.de/>

Coverage. Selected topics from the above textbooks:

1. The basics of R and numerical techniques
2. Random number generation and Sampling techniques (Monte Carlo and bootstrap)
3. Regression models (parametric and non-parametric)
4. Univariate Distribution and statistical Analysis (Descriptive stat, Confidence intervals, Goodness-of-Fit)
5. Advanced graphical techniques in R

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Grading Policy

All exams should be done independently; otherwise you will be guilty of plagiarism. A student who is caught cheating will get an F for the course and will be referred to student judiciaries for further action.

Score	[0, 60)	[60, 70)	[70, 80)	[80, 90)	[90,100]
Letter grade	F	D	C-/C+	B-/B+	A-/A

Extra credit problems will not be assigned. Letter grades will be assigned at the end of the academic term and are based on (schedules are subject to change).

Homework is due by the beginning of class of the due date. Late homework is penalized 5% for the late of each class day.

Homework/Lab	30%, 5 sets. Submission date will be posted at the Blackboard
Midterm exam	30%, 7th week, Wed, March 02, 2022
Final Exam	40%, Wednesday, April 27, at 12:20 p.m.

Assignments (more instructions can be found at the Blackboard)

Assignments are graded on accuracy, completeness, and good programming methods. For programming assignments, your code must be ready to run. Code which does not run may or may not be given partial credit. Document your programs with comments and Zip all files if you have multiple files.

For each assignment submit

- (1) Electronic copy of your program(s),
- (2) Report containing neatly organized and annotated output; including specific answers to any questions,
- (3) Attach any graphs required, labeled as Figure 1, Figure 2, etc. and reference by figure number in part (2). Each figure has to have a caption/title.

Copyrights of class materials. The lectures, classroom activities, and all materials associated with this class and developed by the instructor are copyrighted in the name of the instructor on the date 08/26/2013.

Accommodation for disability. Any student who suspects s/he may need an accommodation based on the impact of a disability should contact the class instructor privately to discuss the student's specific needs within the first week of class and must provide written documentation from the Office of Student Accessibility Services. If the student is not yet registered as a student with a disability, s/he should contact the **Office of Student Accessibility Services**.