

Statistical Computing (Spring 2024)

Title: Statistical Computing, 3 credits

Instructor: Wei-Ying Wu

A432 Science and Engineering Building

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Lectures: Thursday 09:00 am -12:00 pm, Room B301 of Science and Engineering Building I & Computer Lab: A322 Science and Engineering Building I

Office hours: Mon 10:00 am -12:00 pm in A432 or by appointment.

Objectives Description: In this course, based on the basic mathematical, statistical and probability knowledge, we will study various numerical or computational methods. Through this training, the students will be expected to know how to assemble and develop the required computational tools to solve the problems they encountered.

Textbook (optional):

Introduction to scientific programming and simulation using R, (2009) by Jones, Owen; Maillardet, Robert.; Robinson, Andrew. ([online available in NDHU library](#))

Numerical Analysis for Statisticians, (2010) by Lange, Kenneth. ([online available in NDHU library](#))

Computational Statistics, (2005) by Geof H. Givens and Jennifer A. Hoeting .

Teaching Schedule:

Week	
1	Course introduction
2	Introduction of R; Programming by R; Review fundamental concepts in Statistics and Probability; Numerical integration and Monte Carlo integration
3	Monte Carlo integration; Convergence of Numerical Integration; Simulation: Inverse cumulative distribution function method & Rejection Sampling (I)
4	Simulation: Rejection Sampling (II);
5	The empirical distribution function; Density estimation (1) by Parametric estimation & Nonparametric Estimation

6	Density estimation (2) Nonparametric Estimation (Kernel density estimation)
7	Density estimation (3) Nonparametric Estimation (Bandwidth Discussion)
8	Midterm I
9	The jackknife; The bootstrap.
10	Concepts of Root- finding
11	Concepts of Root- finding; Optimization method
12	Maximum Likelihood Estimation (MLE) (Theoretical Discussion & Numerical Discussion) & Expectation-Maximization Method (I)
13	Maximum Likelihood Estimation (MLE) (Theoretical Discussion & Numerical Discussion) & Expectation-Maximization Method (II)
14	Expectation-Maximization Method for Mixture model (I)
15	Expectation-Maximization Method for Mixture model (II)
16	Markov Chain & Markov Chain Monte Carlo (1)
17	Markov Chain Monte Carlo (2)
18	Final Exam

Grading Policy: Course points are earned through General Performance, Assignments, Quizzes, two midterm examinations, and a cumulative final exam:

Source	Percentage
General Performance	10%
Homework	40%
Midterm	25%
Final exam	25%
Total:	100%

Homework: It will be an individual job. Please note that the work you turn in must be your own.

You shall hand in your work before the due date. Late homework will not be permitted. The deadline of assignments will be announced late.

Quizzes: Quiz will be given in every other week. It will be closed book/closed notes.

The exact schedule of quizzes and exams will be mentioned in the class. An unexcused, missed examination or quiz will be counted as a zero.

- * The opportunity of make-up examination and quizzes will not be agreed without any legitimate reason. Please contact the instructor with excuses before the exam or quiz.
- * Many extra credit chances will be provided in class.
- * Attendance of TA's office hour will be very important; the chance of extra credits will be given by TAs, but 3 credits (in the final score) at most.
- * Important course messages will be sent through email. Please check your email very often.
- * Importance: The instructor reserves the right to make any changes he considers academically advisable. Changes will be announced in the class. It is your responsibility to keep up with any changed policies.