DATA130004: Computational Statistics

Fall 2019

Instructor:	Nan Zhang	**Class:**	HGX207, Wed 13:30 – 16:10
Email:	zhangnan@fudan.edu.cn	**Office:**	Zibin N210

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Course Websites:

1. https://zhangnanfudan.github.io/teaching/

2. Wiki: shjkx.wang (username/password: guest.fudan/shanghai)

Office Hours: By appointment.

Textbook: Maria Rizzo (2019). *Statistical Computing with R*, 2nd Edition, CRC

Main References: Some interesting and useful books related to this course:

- Geof Givens and Jennifer Hoeting (2012). *Computational Statistics*, Wiley

- Norman Matloff (2011). *The Art of R Programming: A Tour of Statistical Software Design*, No Starch Press

- Garrett Grolemund and Hadley Wickham (2017) *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*, 1st Edition, O'Reilly Media

Objectives: This course is designed for advanced undergraduates majoring in mathematics, statistics, and computer science. It primarily covers modern topics in computational statistics with an introduction to the statistical programming language R.

Prerequisites: Introductory probability and statistics courses are assumed to be taken, such as DATA130005 and DATA130024 or equivalent ones. Some coding experience is recommended.

Tentative Outline:

- R Basics

- Methods for Generating Random Variables

- Visualization of Multivariate Data

- Monte Carlo Integration and Variance Reduction

- Monte Carlo Methods for Estimation and Hypothesis Tests

- Bootstrap and Jackknife

- Markov Chain Monte Carlo Methods: the Metropolis-Hastings algorithm and the Gibbs sampler

- EM algorithm

- Numerical Methods in R: root-finding in one dimension, numerical integration, linear programming, and etc.

Grading Policy:

Homework .... (10%)
Wiki contribution .... (5%)
Quizzes .... (20%)
Midterm .... (30%)
Final ....(35%)

Homework: Problems will be assigned on course website after class meetings and will be due in class on the following week. **No late homework will be accepted**. Missed homework will receive a grade of zero. You are encouraged to discuss the problems with other students, however, verbatim copying of homework is absolutely forbidden. Therefore each student must ultimately produce his or her own homework to be handed in and graded.

Wiki contribution: Wiki page is designed as a comprehensive resource for this course. Everyone can make contribution. Homework questions and extra exercises will be listed on it and students are assigned to edit solutions or submit R code. Instructor and teaching assistant will help improve and evaluate each student's work.

Quizzes: Two in-class quizzes will be arranged accordingly. Questions are conceptual and related to previous homework.

Midterm: Midterm exam is also in-class. It is required and there will be no make-up exam. It is expected to cover Chapter 1 to 6.

Final: Final exam is scheduled on 15:30-17:30 of **December 30, 2019**. It will cover all topics along the semester.

Quizzes and exams are all closed-book.

Class Policy:

- Regular attendance is recommended.

- Academic honesty: no plagiarism is tolerated.