

DATA130004: COMPUTATIONAL STATISTICS

Fall 2017

Instructor:	Nan Zhang	Class:	Thursday 18:30 – 21:05
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Course Websites:

1. <https://zhangnanfudan.github.io/teaching/>
2. Wiki: shjcx.wang (username/password: guest.fudan/shanghai)

Office Hours: By appointment.

Textbook: Maria Rizzo (2007). *Statistical Computing with R*, CRC

Main References: There are various interesting and useful books related to this course. You can consult them occasionally.

- 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
- Hadley Wickham (2016) *ggplot2: Elegant Graphics for Data Analysis*, 2nd Edition, Springer
- Yihui Xie (2015) *Dynamic Documents with R and knitr*, 2nd Edition, CRC

Objectives: This course is designed for advanced undergraduates majoring in mathematics, statistics, and computer science. It introduces statistical programming language R and covers modern topics in computational statistics.

Prerequisites: Basic knowledge of probability and statistics is assumed. Some coding experience is recommended.

Tentative Outline:

- R Basics
- Probability and Statistics Review
- Methods for Generating Random Variables: inverse transformation; acceptance-rejection
- Visualization of Multivariate Data: surface plots, 3d scatter plots, and contour plots
- Monte Carlo Integration and Variance Reduction: example and applications
- Reproducible research, dynamic report generation with *knitr*
- Monte Carlo Methods for Estimation and Hypothesis Tests
- Bootstrap and Jackknife

- Permutation Tests
- Markov Chain Monte Carlo Methods: the Metropolis-Hastings algorithm and the Gibbs sampler
- Numerical Methods in R: root-finding in one dimension, numerical integration, linear programming, and the EM algorithm

Grading Policy:

Homework	(15%)
Wiki contribution	(5%)
Quizzes	(20%)
Midterm	(30%)
Final	(30%)

Homework: Problems will be assigned on course website after class meetings and will be due in class on the following Thursday. No late homework will be accepted. Missed homework will receive a grade of zero. Each assignment carries equal weight. You are encouraged to work with other students on the homework problems, 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 or 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 the afternoon of January 11, 2018. It will cover all topics along the semester.

Quizzes and exams are closed-book.

Class Policy:

- Regular attendance is recommended
- Academic honesty: no plagiarism is tolerated.