DATA130004: Computational Statistics

Fall 2016

Instructor:	Nan Zhang	**Class:**	Thursday 13:30 – 16:10
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Course Websites:

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

2. Wiki: shjkx.wang (Username/password: guest/beijing)

Office Hours: Wednesday 10:00 – 11:00 or 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

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 and quizzes .... (30%)
Wiki contribution .... (10%)
Midterm .... (30%)
Final/Project .... (30%)

Homework and Quizzes: 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. The homework will be graded, and 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. A few in-class quizzes will be arranged. Questions are typically conceptual or about previous homework.

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 can assign themselves to edit solutions or submit R code. Instructor and teaching assistant will help and evaluate each student's work.

Midterm: There will be one in-class midterm exam. It is required and there will be no make-up exam. It is expected to cover Chapter 1 to 5.

Final/Project: Final exam is cumulative and closed-book. It can be replaced by completing a project. The project is about reproducing results in a related research article. It could be challenging but rewarding.

Class Policy:

- Regular attendance is recommended

- No need to bring your laptop unless you are presenting your work

Academic Honesty: Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation.

"An Aggie does not lie, cheat, or steal or tolerate those who do." by Texas A&M University.