Syllabus

Course Web Page: `blackboard.sdsu.edu`

Meeting Time: Lectures: TR 12:35 - 1:50 p.m. in GMCS 328/422

Instructor: Professor Richard Levine
GMCS 565
email: ralevine@sciences.sdsu.edu
Office Hours: TR 3:00 - 4:00 pm

Reference: The textbook for the course is

M. L. Rizzo, 2008, *Statistical Computing with R*, Chapman & Hall/CRC. New York.

The course blackboard page contains additional information and material about *R*.

Objectives: Computational speed and power has revolutionized the field of statistics both in theoretical research and applications. This course will provide you with some of the computational techniques used by statistical researchers and practitioners beyond standard statistical software packages. The goal is to expand your statistical toolbox through numerical and simulation methods. Additionally, the material will teach you how to approach statistical problems from a computational perspective as a complement to the theoretical training you receive in mathematical statistics courses and work.

Homework: Homework assignments will be available on the course blackboard page throughout the semester as announced in class. The homeworks will be due one to two weeks following the class announcements of their availability. The exact due date for each homework will be given at that time.

Homeworks must be handed in by the beginning of lecture on the due date. **No late homeworks will be accepted**.

You are encouraged to discuss homework problems with other students, but you should write up your solutions independently. **Your homework solutions for problems requiring computing must include concise computer output properly edited, labeled, and neatly displayed and an appendix with a documented, clearly presented version of your code**.

Laboratory Practicals: During specified class periods throughout the semester, we will have laboratory practicals in GMCS 422 during which you will perform computing experiments based on the topic material under study those weeks. These experiments will require programming, data analysis, and either written or oral responses to problems assigned in the lab. Explicit instructions for lab work and group participation will be provided during that lab period and all practical work must be handed in by the end of the lab session. **No late practicals will be accepted.**

Exams: There will be one midterm the week of March 15, the exact date to be determined. The exam will be closed notes. **No makeup exams are given- no exceptions**.

The final exam time is Tuesday May 18 from 1:00 to 3:00 p.m. **No makeup exams are given- no exceptions**.

No collaboration of any kind is allowed on the exams.

Project: As part of the course you will be asked to do a project. The project grade will be based in part on a 15-20 minute presentation (depending on the size of the class) during the week of May 3.

You are required to attend *all* project presentations. Attendance at the presentations will be a part of your project grade.

Each project will entail studying a topic in statistical computing not covered in the course. I will give a list of potential topics during the fifth week or so of the semester. In consultation with me, you may choose one of these topics or another area/problem in statistical computing methods of interest. The specific project must be decided upon by the eighth week. As part of the project, expect to read introductory articles in the literature about the area chosen and to analyze data or perform a computer numerical/simulation analysis to illustrate the techniques/methods studied.

Grading: The grade for the class is based on a score composed of the following

Laboratory practicals & homework assignments	30%
Midterm Exam	25%
Project	20%
Final Exam	25%

Computing: Homework assignments and laboratory practicals will require computer programming. You must turn in properly edited, labeled, and neatly presented concise computer output and an appendix with a well-documented version of your code used to solve each homework and laboratory problem on the computer.

We will encourage the use of *R* as a programming tool for the course. The lectures, laboratory, and homework problems will be geared towards *R* programming. *R* is installed on the PCs in GMCS 422/428. You may also download *R* from the web site `www.r-project.org`. The *R* project web site and course blackboard page contain links to primers and introductory materials on *R*. We will have an introduction to *R* session during one of the first two weeks of classes, time to be announced. As the prerequisite for the course is experience with a programming language, **it is your responsibility to learn *R*.** Of course you are encouraged to ask me any questions regarding *R* programming.

If you prefer to use a language other than *R* for this course, feel free to utilize it as long as it is available in GMCS 422, your code is well-documented, and the output turned in is edited and clearly presented. The homeworks will involve matrix and numerical computations, simulations, statistical analyses, and graphics. You may therefore want to consult with me about the applicability of a programming language before using it in the course. *However, coding assistance and help from me will be provided only for R.*

Topics to be covered: basic outline; topics may be added and/or dropped as the semester proceeds and time allows

1. Introduction to statistical computing
2. Least squares (regression)
   a. Penalized and weighted least squares
   b. Density estimation and smoothing
   c. Matrix computations
3. Optimization (likelihood estimation)
   a. Newton-Raphson
   b. Fisher scoring
   c. Combinatorial optimization
4. Integration (probabilities)
   a. Quadrature
   b. Laplace approximation
5. Resampling and Monte Carlo inferences
   a. Jackknife and Bootstrap
   b. Permutation procedures
   c. Monte Carlo simulation
6. Statistical graphics

Prerequisites: A calculus-based probability and mathematical statistics sequence (STAT 551AB) and experience in computer programming. An introductory applied statistics course is recommended (STAT 350AB, STAT 510, or the equivalent).

Tardiness and Early exits: The class time is from 12:35 - 1:50 p.m. As common courtesy to your fellow students, we would appreciate if you show up to class on time and leave when dismissed at 1:50. If you must leave early, please inform me and sit on the aisle near an exit so as not to disturb students listening to and trying to learn from the lectures.

Code of Academic Conduct on Examinations and Assignments: "At San Diego State University, students are invited to be active members of the educational community. As with any community, its members serve a vital role in determining acceptable standards of conduct, which includes academic conduct that reflects the highest level of honesty and integrity." The "Statement of Student Rights and Responsibilities clarifies for students their role as members of the campus community, setting forth what is expected of them in terms of behavior and contributions to the success of our university." "Inappropriate conduct by Students ... is subject to discipline on all San Diego State University Campuses. The Center for Student Rights and Responsibilities coordinates the discipline process and establishes standards and procedures in accordance with regulations contained in Sections 41301 of Title 5 of The California Code of Regulations, and procedures contained in Executive Order 970, Student Conduct Procedures for the California State University." See http://csrr.sdsu.edu for more information.

Other information: See course web page `blackboard.sdsu.edu`