

# Stat 580 Syllabus – Spring 2014

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Office Hrs	TR 1:1:50 pm , or by appointment
Lecture	TR 11:00-12:15
Location	Snedecor 2113
Webpage	<a href="http://www.public.iastate.edu/~maitra/stat580/sp2014.html">http://www.public.iastate.edu/~maitra/stat580/sp2014.html</a>
Textbook	None required.
Grades	Homeworks: 50%, Project: 50%.

## Course Description

**Stat 580. Statistical Computing.** Cr. 3. *Prereq: Stat 579 and 447 or 542.* Introduction to scientific computing for statistics using tools and concepts in R: programming tools, modern programming methodologies, modularization, design of statistical algorithms. Introduction to C programming for efficiency; interfacing R with C. Building statistical libraries. Use of algorithms in modern subroutine packages, optimization and integration. Implementation of simulation methods; inversion of probability integral transform, rejection sampling, importance sampling. Monte Carlo integration.

## Course Information

**Textbook:** There is no required textbook for this class. However, you may find the following books useful for understanding course concepts:

- *Stochastic Simulation* by Brian D. Ripley, John Wiley and Sons, 1987.
- *Computational Statistics* by Geof H. Givens and Jennifer A. Hoeting, John Wiley and Sons, 2005.
- *Elements of Computational Statistics* by James E. Gentle, Springer-Verlag, 2010.
- *Numerical Methods in Statistical Computing for the Social Scientist* by Micah Altman, Jeff Gill and Michael P. McDonald, John Wiley, 2004.
- *C Programming Language (2nd Edition)* by Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988.
- *Modern Applied Statistics in S* by W. N. Venables and B. D. Ripley, Springer-Verlag, 2002.
- *Numerical Analysis for Statisticians (Statistics and Computing)*, 2nd edition, by K. Lange, Springer-Verlag, 2010.
- *Numerical Methods of Statistics* by John F. Monahan, Cambridge University Press, 2001.

**Homework:** Individual practice (homework) is an important part of learning and *essential* for learning how to program. Homework assignments will be due by midnight on the due date. Solutions will be posted on the course website.

**Project:** There will be a group project. Groups of up to two students will work on one project. The final output should be a six-page single-spaced manuscript in 12pt font. Important dates and other format of the class project will be decided in consultation with all students.

**Computer Programming:** The low-level programming language taught and used in this class will be C. C is a programming language developed by Dennis M. Ritchie in the early 1970's at AT&T's Bell Laboratories. A history of the development of the C Language is provided by Dennis M. Ritchie at <http://cm.bell-labs.com/cm/cs/who/dmr/chist.html>.

You are free to program under your favorite environment (see Computer Operating System, below), however the programs you turn in for credit must compile using the GNU C compiler and run from the Linux command-line (from example on linux10).

**Statistical Software:** The statistical software used throughout this class will be R. It is a comprehensive statistical software package freely available from <http://www.R-project.org/>. R is developed by a team of international researchers and operates under the GNU General Public License (GPL) and is free. Since the software is freely available, you may download it from the above web site and use it on your home computer. You may use either the Windows version or the Unix/Linux version. Please note that your installation of R is at your own risk, though the department systems administrators can perhaps help.

**Computer Operating System:** The operating system used in this class will be the Linux operating system. In layman's terms, an operating system is a program that supervises the working of a computer. Other popular operating systems are Microsoft Windows, Mac OS and the Unix operating system. Linux is a free Unix-type operating system originally created by Linus Torvalds with the assistance of developers around the world. Developed under the GPL, the source code for Linux is freely available to everyone. More information on the Linux operating system is available at <http://en.wikipedia.org/wiki/Linux>. Because of the free and open code base, Linux is particularly useful for cheap, scientific computing. Linux can be (and is) packaged in several forms. Each of these are called distributions: examples are Fedora Core (sponsored by Redhat), Ubuntu, SuSE (now owned by Novell), Mandrake, etc. Iowa State University has site licenses for the Redhat Enterprise Linux operating system. You may use this, or any other linux distribution. The statistics department has high-performance machines which run linux. There is also a linux lab at the University's Academic Information Technologies building in Durham Hall. Feel free to install Linux at home.

#### **Tentative Core Topics.**

- Simulation
- Linear equations, matrix calculations
- Optimization, nonlinear equations
- Integration

**Tentative Applications.** We will go over selected topics briefly and only as far as needed for our examples. The theory and methodology behind many of these topics are covered in detail in Stat 680.

## **Course Policies**

**Academic Dishonesty:** The class will follow Iowa State University's policy on academic dishonesty. Anyone suspected of academic dishonesty will be reported to the Dean of Students Office. <http://www.dso.iastate.edu/ja/academic/misconduct.html>.

**Disability Accommodation:** Iowa State University complies with the Americans with Disabilities Act and Sect 504 of the Rehabilitation Act. If you have a disability and anticipate needing accommodations in this course, please contact me (Ranjan Maitra) to set up a meeting within the first two weeks of the semester or as soon as you become aware of your need. Before meeting with (instructor name), you will need to obtain a SAAR form with recommendations for accommodations from the Disability Resources Office, located in Room 1076 on the main floor of the Student Services Building. Their telephone number is 515-294-7220 or email [disabilityresources@iastate.edu](mailto:disabilityresources@iastate.edu) . Retroactive requests for accommodations will not be honored.

**Dead Week:** This class follows the Iowa State University Dead Week policy as noted in section 10.6.4 of the Faculty Handbook.

**Harassment and Discrimination:** Iowa State University strives to maintain our campus as a place of work and study for faculty, staff, and students that is free of all forms of prohibited discrimination and harassment based upon race, ethnicity, sex (including sexual assault), pregnancy, color, religion, national origin, physical or mental disability, age, marital status, sexual orientation, gender identity, genetic information, or status as a U.S. veteran. Any student who has concerns about such behavior should contact his/her instructor, Student Assistance at 515-294-1020 or email [dso-sas@iastate.edu](mailto:dso-sas@iastate.edu), or the Office of Equal Opportunity and Compliance at 515-294-7612.

**Religious Accommodation:** If an academic or work requirement conflicts with your religious practices and/or observances, you may request reasonable accommodations. Your request must be in writing, and your instructor or supervisor will review the request. You or your instructor may also seek assistance from the Dean of Students Office or the Office of Equal Opportunity and Compliance.

**Contact Information:** If you are experiencing, or have experienced, a problem with any of the above issues, email [academicissues@iastate.edu](mailto:academicissues@iastate.edu).

**Grading:** Letter grades including plus/minus will be given based on performance on homework and projects. The specific grading scale is not determined until after all grades have been calculated.

January 27, 2014