

MATH 680: COMPUTATION INTENSIVE STATISTICS

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Office Hour : Monday 3:00pm–5:00pm

Recommended Textbooks : *Numerical Analysis for Statisticians* (2nd Ed) by K. Lange
Monte Carlo Statistical Methods (2nd Ed) by C. Robert and G. Casella
Introducing Monte Carlo Methods with R by C. Robert and G. Casella

Evaluation : Three projects (90 %), In-class presentations/participation (10 %)

TARGET SYLLABUS

1 Optimization and Root Finding

- Recursion and Taylor approximations
- Newton/Quasi-Newton methods
- EM and MM algorithms
- Block methods and coordinate descent

2 Numerical integration

- Analytic approximations
- Numerical approximations
- Orthogonal polynomials & quadrature

3 The bootstrap

- Basic theory and applications
- More advanced applications

4 Monte Carlo Methods

- Principles of Monte Carlo
- Importance sampling
- Random number generation
- Congruential generators for Uniform random variables
- Transformation methods
- Rejection sampling
- Markov chain Monte Carlo (MCMC): Theory
- Applications of MCMC
- Sequential Monte Carlo

Notes

- 1 **Computation:** The main computational language used in the course will be R.
- 2 **Assessments and Plagiarism:** Any material (assignment solution scripts, R scripts etc.) that you hand in for assessment *should be your work alone*, unless the Assignment concerned is a designated Group Project. This does not mean that you cannot consult or collaborate with others, merely that the material submitted for assessment **must have been produced by you**.

MCGILL UNIVERSITY POLICY STATEMENTS

The following three statements are included in this course outline, in keeping with Senate resolutions:

- 1 *McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the **Code of Student Conduct and Disciplinary Procedures**. For more information, see*

www.mcgill.ca/students/srr/honest/

[Approved by Senate on 29 January 2003]

- 2 *In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.*

[Approved by Senate on 21 January 2009]

- 3 *Instructors who may adopt the use of text-matching software to verify the originality of students' written course work must register for use of the software with Educational Technologies and must inform their students before the drop/add deadline, in writing, of the use of text-matching software in a course.*

[Approved by Senate on 1 December 2004]

If you have a disability and need special arrangements, please contact the **Office for Students with Disabilities** at 514-398-6009.

David A. Stephens.
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