# MATH 680: COMPUTATION INTENSIVE STATISTICS

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| Website: | www.math.mcgill.ca/∼dstephens/680/ |
| Office Hour : | Monday 11:30-13:30 |
| Recommended Textbooks : | *Numerical Analysis for Statisticians* (2nd Ed) by K. Lange<br>*Monte Carlo Statistical Methods* (2nd Ed) by C. Robert and G. Casella<br>*Introducing Monte Carlo Methods with R* by C. Robert and G. Casella |
| Evaluation : | Three projects (90 %), In-class participation (10 %) |

## TARGET SYLLABUS

1 Optimization and Root Finding
   - 1.1 Recursion and Taylor approximations
   - 1.2 Newton/Quasi-Newton methods
   - 1.3 EM and MM algorithms
   - 1.4 Block methods and coordinate descent

2 Numerical integration

3 Random number generation
   - 3.1 Congruential generators for Uniform random variables
   - 3.2 Transformation methods
   - 3.3 Rejection sampling

4 The bootstrap
   - 4.1 Basic theory and applications
   - 4.2 More advanced applications

5 Monte Carlo methods for numerical integration
   - 5.1 Monte Carlo
   - 5.2 Importance sampling
   - 5.3 Quasi-Monte Carlo
   - 5.4 Markov chain Monte Carlo (MCMC): Theory
   - 5.5 Applications of MCMC
   - 5.6 Sequential Monte Carlo

## ACADEMIC INTEGRITY

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**for more information**).

- 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.
- In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

David A. Stephens.
September 1, 2010