

STAT 4600/7240: Computational Statistics

Tentative Course Outline

Winter Term 2012

Instructor: Alexandre Leblanc
Office: 324 Machray Hall
Phone: 474-6273
E-mail: alex.leblanc@umanitoba.ca

Course Schedule: Tuesday/Thursday 10:00 to 11:30 am (Slot 5), in 316 Machray Hall.

Textbook: The course should be based mainly on material that is available for free through the online catalogue of the University of Manitoba Libraries.

Because of this, you will not be expected to buy a textbook.

Interesting references (all available online) are:

Computational Statistics:

- Gentle, J.E. (2009), *Computational Statistics*, Springer.
- Lange, K. (2010), *Numerical Analysis for Statisticians*, Springer.
- Robert, C.P. and Casella, G. (2011), *Introducing Monte Carlo Methods with R*, Springer.

Statistics using R:

- Albert, J. (2007), *Bayesian Computation with R*, Springer.
- Dalgaard, P. (2008), *Introductory Statistics with R*, Springer.

Outline of Covered Topics:

This course will be focusing on computational/numerical aspects of Statistics and on some of the computer intensive methods used in Statistics. Hence, you will need to make extensive use of the computer throughout the whole course for your homework/assignments.

General topics should include:

- the need for numerical methods for statistical inference: maximum likelihood methods, Bayesian methods, moment-based methods, M -estimation;
- some deterministic numerical methods of optimization and integration;
- pseudo-random number generation;
- more numerical methods: independent Monte Carlo, MCMC methods, EM algorithm;
- permutation tests;
- resampling methods and the bootstrap.

Other topics that could be covered are:

- model building: model selection and model averaging;
- issues related with complex models: missing/censored data, measurement errors;
- smoothing and nonparametric function estimation using cross-validation;
- robust statistics: truncated statistics and data depth.

Statistical Package:

As mentioned above, you will need to make extensive use of the computer throughout the whole course for your homework/assignments. Specifically, we will use the *R* statistical package which can be downloaded for free (for Windows or Mac, including PDF documentation) from the *Comprehensive R Archive Network* at: <http://cran.r-project.org/>

Breakdown of the Marks:	Assignments (5)	25%
	Midterm Test	25%
	Final Exam	50%

About the Midterm Test and Final Exam:

The test and exam should each have a take-home part that will require the use of the computer.

The Midterm Test will be scheduled in mid-February, the exact date to be determined later. However, it will be scheduled outside of regular class time (probably in the afternoon) and will be 1.5 or 2 hours in duration. The Final Exam will be held on a date to be selected later by the Department of Statistics and will be 3 hours in duration.

About Assignments:

Assignments will be handed out at a rate of about one assignment per two/three weeks of class. Students are encouraged to discuss and work together on the solutions to the assignments. However, each student must hand in his or her own copy of each assignment with personalized solutions, including comments, discussions and interpretations.

Students registered in STAT 7240:

The material covered in class will essentially be at the 4600 level. If you are a graduate student registered in STAT 7240, you will be expected to:

- complete the assigned supplementary readings;
- answer typically 2 or 3 extra questions for each assignment.

In addition, the test and exam for students registered in STAT 4600 and 7240 will differ to some extent, with probably about 50% of common questions.