

McMaster University
Department of Mathematics and Statistics
STATISTICS 4CI3/6CI3: Computational Methods for Inference
Winter 2019

Instructor	Angelo J. Canty
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Course Web Site	http://www.math.mcmaster.ca/canty/teaching/stat4ci3
Time of Lectures	Monday 1:30 – 2:20 Wednesday 1:30 – 2:20 Thursday 1:30 – 2:20
Location	HH 104
Office Hours	Monday 2:30–3:30 Wednesday 2:30–3:30 Thursday 2:30–3:30 or at other times by prior appointment.
Text	There is no required text for this course but the material will be taken from the following texts <i>Introducing Monte Carlo Methods with R</i> C. Robert & G. Casella, Springer, 2010. <i>Bootstrap Methods and Their Application</i> A.C. Davison and D.V. Hinkley, Cambridge University Press, 1997.

Grading Scheme :

The final grade for undergraduate students (S4CI3) will be based on the following components

1. 40% for 4 assignments.
2. 30% for the midterm test.
3. 30% for the final exam.

The final grade for graduate students (S6CI3) will be based on the following components

1. 30% for 4 assignments.
2. 25% for the midterm test.
3. 25% for the final exam.
4. 20% for a course project.

Note that there may be an extra question on assignments for graduate students.

Notes :

- Students who miss work during the term for medical or other reasons should review and follow the Academic Regulation in the Undergraduate Calendar “*Requests for Relief for Missed Academic Term Work*”. Please note that these regulations have changed beginning Fall 2015. In particular, the online MSAF may not be used for your term test since it is worth more than 25% of your final grade so students will be required to provide the Associate Dean with appropriate documentation in the event of a missed test and also to see the instructor to discuss any possible accommodation. For missed assignments the MSAF system may be used once and the total assignment grade will be calculated based on the other 3 assignments.
- Tentative due dates for the assignments will be at **the start of class** on Feb. 4, Feb. 25, Mar. 18, and Apr. 8. Assignments will be posted on the web site at least 1 week before the due date.
- The midterm test will be held during class time. Tentative date for the test is March 7. The test will take place in the usual lecture room during regular class time. The exact coverage of the test will be announced in class.
- The final exam will take place during the April examination period and will cover the entire course. It will be a 2.5 hour exam common to both graduate and undergraduate students.
- The project for Stat 6CI3 will require students to conduct a simulation study and to write a report describing the study and the results. Students are required to submit a short (1 page) proposal prior to starting their project. The final date for submission of the proposal is March 21, 2018. The final report should be about 10 pages and be formatted using LaTeX. It should be submitted electronically accompanied by a file of commented R code used by April 19, 2018. No extensions of this date will be granted.

Important Notice: The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their **McMaster** email and course websites weekly during the term and to note any changes.

Academic Dishonesty

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at http://www.mcmaster.ca/senate/academic/ac_integrity.htm

The following illustrates only three forms of academic dishonesty:

- Plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
- Improper collaboration in group work.
- Copying or using unauthorized aids in tests and examinations

Brief Outline of the Course

This course is designed to introduce students to important computational techniques used in modern statistical inference. Students will also be introduced to programming in R and all computation in this course is expected to be done in this language. R may be downloaded free of charge from <https://cran.r-project.org> for Windows, Macintosh or Linux operating systems. Students are not required to know R but may find it helpful to consult some of the available online documentation such as

- *An Introduction to R* by W.N. Venables, D.M. Smith and the R Core Team.
- *R for Beginners* by Emmanuel Paradis.
- There is also much more useful documentation available at <http://cran.r-project.org/other-docs.html>
- There are also books on R (or S on which R is based) programming available in the Thode library.

The topics to be covered in the course will be

1. Fundamentals of programming in R;
2. Computer generation of random variates;
3. The Monte Carlo method and simulation;
4. Introduction to simulation studies;
5. Markov chain Monte Carlo methods;
6. Jackknife and bootstrap estimation of bias and variance;
7. Monte Carlo hypothesis testing;
8. Bootstrap confidence intervals.