

SPRING 2016 - STAT 853 G100

**APPLICATIONS OF STATISTICAL COMPUTING (4)***Class Number: 5610 Delivery Method: In Person***COURSE TIMES + LOCATION:**

Mo, We 10:30 AM – 12:20 PM

AQ 5005, Burnaby

**INSTRUCTOR:**

David Campbell

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Office: Surrey 2911/SC-K10564

**PREREQUISITES:**

STAT 830 or equivalent or permission of instructor.

## Description

**CALENDAR DESCRIPTION:**

An introduction to computational methods in applied statistics. Topics can include: the bootstrap, Markov Chain Monte Carlo, EM algorithm, as well as optimization and matrix decompositions. Statistical applications will include frequentist and Bayesian model estimation, as well as inference for complex models. The theoretical motivation and application of computational methods will be addressed.

**COURSE DETAILS:****Course Outline:**

## Statistical Software:

-For loops, vectorization, reproducible research, parallel computing, pseudorandom number generation, symbolic differentiation

## Optimization:

- Gradient methods, gradient free methods, genetic algorithms

## Statistical Inference:

-Bootstrap, EM algorithm, cross validation, profile and conditional likelihoods

## Bayesian methods:

-Metropolis Hastings, Gibbs Sampling, mixture models, parallel tempering, sequential monte carlo, hamiltonian monte carlo, slice sampling

## Methods for intractable likelihoods:

- Approximate methods, Integrated Nested Laplace Approximation, variational Bayes

Machine Learning:  
- Neural Networks / Deep Learning

## Grading

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Assignments	50%
Projects	50%

NOTES:

***All grading is subject to change***

## Materials

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REQUIRED READING:

**Statistical Computing with R** by Maria L. Rizzo. Publisher: Chapman and Hall/CRC

ISBN: 9781584885450

RECOMMENDED READING:

**Using R for Numerical Analysis in Science and Engineering** by Victor R. Bloomfield. Publisher: Chapman and Hall/CRC

ISBN: 9781439884485

**Introduction to Scientific Programming and Simulation Using R, 2nd ed.** by Owen Jones, Robert Maillardet, and Andrew Robinson

ISBN: 9781466569997

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GRADUATE STUDIES NOTES:

Important dates and deadlines for graduate students are found here: [http://www.sfu.ca/dean-gradstudies/current/important\\_dates/guidelines.html](http://www.sfu.ca/dean-gradstudies/current/important_dates/guidelines.html). The deadline to drop a course with a 100% refund is the end of week 2. The deadline to drop with no notation on your transcript is the end of week 3.

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REGISTRAR NOTES:

SFU's Academic Integrity web site <http://students.sfu.ca/academicintegrity.html> is filled with information on what is meant by academic dishonesty, where you can find resources to help with your studies and the consequences of cheating. Check out the site for more information and videos that help explain the issues in plain English.

Each student is responsible for his or her conduct as it affects the University community. Academic dishonesty, in whatever form, is ultimately destructive of the values of the University. Furthermore, it is unfair and discouraging to the majority of students who pursue their studies honestly. Scholarly integrity is required of all members of the University. <http://www.sfu.ca/policies/gazette/student/s10-01.html>

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