DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus
Department of Mathematics and Statistics
STAT/MATH 5067
Advanced Statistical Theory II
Winter 2019

Instructor(s): Dr. Edward Susko, Edward.Susko@gmal.com, Chase 202

Lectures: MWF 10:30-11:30, Chase 227

Course Description

This course builds upon the material of Statistics 4066/5066. After a review of probability theory, statistical theory for the major methods of estimation will be rigorously developed. Topics include statistical consistency, limiting distributions of estimators, limiting distributions for testing in likelihood settings and transformations of confidence regions. Asymptotic optimality for point estimation, testing and confidence regions will be defined and optimality results will be established for likelihood methods. Laplace approximation will be used to investigate the properties of Bayesian methods and to derive the BIC model selection criterion.

Course Prerequisites

STAT4066/5066

Course Objectives/Learning Outcomes

The student will be able to derive and apply the delta-method for obtaining the standard error of an estimator. The student will be able to establish the statistical consistency of estimators and know under what conditions consistency does not hold for major methods of estimation. The student will be able to derive higher order asymptotic approximations. The student will understand how to transform confidence regions so that they have good properties. The student will learn the techniques required to derive limiting distributions of estimators for a number of classes of estimation. They will be able to recognize the types of regularity condition violations that cause standard theory not to apply. The student will learn how to determine the efficiency of an estimator. M-estimation will be introduced and students will learn that ML estimation is the most efficient form of M-estimation. The limiting distributions of the major statistical testing approaches for likelihood methods will be derived and the student will learn that they are often locally most powerful tests. The student will learn that there is a duality between testing and confidence interval estimation and use that duality to determine locally optimal confidence regions. The student will learn how to apply Laplace approximation to determine properties of Bayesian procedures. Laplace approximation will be used to establish

connections between likelihood methods and Bayesian procedures and will be used to derive the BIC model selection criterion.

Course Materials

- Mathematical Statistics: Basic Ideas and Selected Topics (2nd Edition). Peter J. Bickel and Kjell A. Doksum.

Course Assessment

Component	Weight (% of final grade)	Date
Midterm	20%	Wed, Mar 6, 10:00-11:30
Final exam	30%	Wed, Apr 15, 9:30-12:30
Assignments	50%	9-10 weekly assignments

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (<50)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies

Late assignments received prior to marked assignments being handed back will be accepted with a late penalty of 5%; assignments are usually handed back at the lecture after they were due. Missed tests will be written at a later date if sufficient reason can be given for missing the test.

Course Content

Review of Probability Theory
Statistical Consistency
Higher-Order Asymptotic Approximations and Transformation of Confidence Regions
Limiting Distributions of Estimators and Test Statistics
Locally Most Powerful Testing and Locally Optimal Confidence Regions
Bayesian Inference
Additional Topics

ACCOMMODATION POLICY FOR STUDENTS

DALHOUSIE UNIVERSITY

Students may request accommodation as a result of barriers related to disability, religious obligation, or any characteristic protected under Canadian Human Rights legislation. The full text of Dalhousie's Student Accommodation Policy can be accessed here: http://www.dal.ca/dept/university_secretariat/policies/academic/student-accommodation-policy-wef-sep--1--2014.html

Students who require accommodation for classroom participation or the writing of tests and exams should make their request to the **Advising and Access Services Centre (AASC)** prior to or at the outset of the regular academic year. More information and the ***Request for Accommodation*** form are available at www.dal.ca/access.

ACADEMIC INTEGRITY

Academic integrity, with its embodied values, is seen as a foundation of Dalhousie University. It is the responsibility of all students to be familiar with behaviours and practices associated with academic integrity. Instructors are required to forward any suspected cases of plagiarism or other forms of academic cheating to the Academic Integrity Officer for their Faculty.

The Academic Integrity website (http://academicintegrity.dal.ca) provides students and faculty with information on plagiarism and other forms of academic dishonesty, and has resources to help students succeed honestly. The full text of Dalhousie's ***Policy on Intellectual Honesty*** and ***Faculty Discipline Procedures*** is available here:

http://www.dal.ca/dept/university_secretariat/academic-integrity/academic-policies.html

STUDENT CODE OF CONDUCT

Dalhousie University has a student code of conduct, and it is expected that students will adhere to the code during their participation in lectures and other activities associated with this course. In general:

"The University treats students as adults free to organize their own personal lives, behaviour and associations subject only to the law, and to University regulations that are necessary to protect

- the integrity and proper functioning of the academic and non – academic programs and activities of the University or its faculties, schools or departments;
- the peaceful and safe enjoyment of University facilities by other members of the University and the public;
- the freedom of members of the University to participate reasonably in the programs of the University and in activities on the University's premises;
- the property of the University or its members."

The full text of the code can be found here:
http://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

DALHOUSIE UNIVERSITY

SERVICES AVAILABLE TO STUDENTS

The following campus services are available to help students develop skills in library research, scientific writing, and effective study habits. The services are available to all Dalhousie students and, unless noted otherwise, are free.

Service	Support Provided	Location	Contact
General Academic Advising	Help with - understanding degree requirements and academic regulations - choosing your major - achieving your educational or career goals - dealing with academic or other difficulties	**Killam Library Ground floor** Rm G28 ***Bissett Centre for Academic Success***	In person: Killam Library Rm G28 By appointment: - e-mail: advising@dal.ca - Phone: (902) 494-3077 - Book online through MyDal
Dalhousie Libraries	Help to find books and articles for assignments Help with citing sources in the text of your paper and preparation of bibliography	**Killam Library Ground floor** Librarian offices	In person: Service Point (Ground floor) By appointment: Identify your subject librarian (URL below) and contact by email or phone to arrange a time: http://dal.beta.libguides.com/sb.php?subject_id=34328
Studying for Success (SFS)	Help to develop essential study skills through small group workshops or one-on-one coaching sessions Match to a tutor for help in course-specific content (for a reasonable fee)	**Killam Library 3rd floor** Coordinator Rm 3104 Study Coaches Rm 3103	To make an appointment: - Visit main office (Killam Library main floor, Rm G28) - Call (902) 494-3077 - email Coordinator at: sfs@dal.ca or - Simply drop in to see us during posted office hours **All information can be found on our website: www.dal.ca/sfs**
Writing Centre	Meet with coach/tutor to discuss writing assignments (e.g., lab report, research paper, thesis, poster) - Learn to integrate source material into your own work appropriately - Learn about disciplinary writing from a peer or staff member in your field	**Killam Library Ground floor** Learning Commons & Rm G25	To make an appointment: - Visit the Centre (Rm G25) and book an appointment - Call (902) 494-1963 - email writingcentre@dal.ca - Book online through MyDal We are open six days a week **See our website: writingcentre.dal.ca**