DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus

Department of Math & Statistics
Stat 3340/Math3340
Regression and Analysis of Variance
Fall 2017

Instructor(s): Bruce Smith bruce.smith@dal.ca Chase 309

Lectures: MWF 8:35-9:25 LSC C238

Laboratories: none

Tutorials: none

Course Description

A thorough treatment of the theory and practice of regression analysis. Topics include: fitting general linear models using matrices, optimality of least squares estimators (Gauss-Markov theorem), inferences, simple and partial correlation, analysis of residuals, case-deletion diagnostics, polynomial regression, transformations, use of indicator variables for analysis of variance and covariance problems, model selection, and an introduction to nonlinear least squares. This course makes extensive use of computer packages.

Course Prerequisites

STAT 2080.03, MATH 2030.03 and either MATH 1010.03 or STAT 2060.03 or DISP (except SCEI 1540X/Y.27)

Course Objectives/Learning Outcomes

1. Calculate the least squares intercept and slope given (x_i, y_i) data.
2. Evaluate expectation and variance of linear combinations of random variables using matrix operations.
3. Calculate least squares estimates for the multiple regression model using matrix operations.
4. Prove that the least squares estimates are unbiased, and evaluate their covariance matrix.
5. Calculate and interpret entries in the analysis of variance table.
6. Calculate case deletion diagnostics given residuals and leverage values.
7. Determine adequacy of regression models using residual plots, leverage measures and case deletion diagnostics.
8. Choose a transformation of the response to produce variance homogeneity, using computer plots and likelihood methods.
7. Select an appropriate multiple regression model given plots and descriptions of the variables.

DALHOUSIE UNIVERSITY

8. Describe the importance and use of the Gauss-Markov and Cochran's theorem in regression modelling.
9. Construct confidence intervals for model parameters given computer output or formulae for the standard error.
10. Carry out hypothesis tests on single or several model parameters to determine whether some variables can be removed from a model, using computer output.
11. Given replicate observations, test for lack of fit of a model.
12. Use the statistical package R to plot and manipulate date and to fit simple and multiple regression models.
13. Use R to calculate automatic variable selection strategies, given a response and several predictor variables.

Course Materials

Required text: Introduction to Linear Regression Analysis, 5th Edition, Montgomery, Peck and Vining

Statistical software: **Most assignments will require use of the statistical software package R. You can download the software at http://www.r-project.org/ Online tutorials are at**
http://cran.r-project.org/doc/manuals/R-intro.html
and
http://www.statmethods.net/
To organize their work, some use Rstudio, which is available at
https://www.rstudio.com/

One or more assignments may use the SAS software package, available on computers in the Learning Commons.

DALHOUSIE UNIVERSITY

Course Assessment

Component	Weight (% of final grade)	Date
Tests/quizzes		
Midterm I	15	Oct 2, LSC 242, 8:35-9:25 AM
Midterm II	15	Oct 30, LSC 242, 8:35-9:25 AM
Final exam	*40*	*(Scheduled by Registrar)*
Assignments	***30***	

6 assignments, 5% each, due approximately every second week except for weeks with tests.

Other course requirements

There will be no supplemental exam.

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

Assignments are to be submitted at the beginning of class on the due date.
Late assignments will not be accepted.
It is expected that each student will write up their assignment independently. Students submitting identical assignments will receive a mark of 0 for that assignment.
If you are ill on the day of a test, you must advise me of this fact before the test, and bring a doctor's note before you can write a make-up test.
Assignments and some notes will be made available at bsmith.mathstat.dal.ca/stat3340

Marks will be available on BrightSpace

Course Content

We will cover much of the material in the first 11 chapters of the book.

- Simple linear regression
- Multiple linear regression and its matrix formulation
- Assessing model adequacy and transformations
- Regression diagnostics (influential points and multicollinearity)
- Special types of regression: polynomial and indicator variable regression
- Model building and variable selection
- Special topics (generalized linear models, nonlinear regression) - time permitting

DALHOUSIE UNIVERSITY

ACCOMMODATION POLICY FOR STUDENTS

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.

DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus (Section B) **(revised 5-June-2017)**

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.
Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).
Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.
Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness
Statement: http://www.dal.ca/cultureofrespect.html)

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit the office (Rm 3037, McCain Building), e-mail (elders@dal.ca) or leave message (902-494-6803).
Information: https://www.dal.ca/campus_life/communities/native.html

Important Dates in the Academic Year (including add/drop dates)
https://www.dal.ca/academics/important_dates.html

University Grading Practices
https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

DALHOUSIE UNIVERSITY

Student Resources and Support

Advising

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: https://www.dal.ca/faculty/science/current-students/academic-advising.html

Aboriginal Student Centre: https://www.dal.ca/campus_life/communities/native.html

Black Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports

Library: https://libraries.dal.ca/

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Copyright Office: https://libraries.dal.ca/services/copyright-office.html

Fair Dealing Guidelines https://libraries.dal.ca/services/copyright-office/fair-dealing.html

Other supports and services

Student Health Services: https://www.dal.ca/campus_life/health-and-wellness/health-services/services.html

Counselling: https://www.dal.ca/campus_life/health-and-wellness/counselling.html

Student Advocacy: https://www.dsu.ca/services/community-student-services/student-advocacy-service

Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Safety

Research Lab Safety
https://www.dal.ca/content/dam/dalhousie/pdf/dept/safety/lab_policy_manual_2007.pdf

Biosafety: https://www.dal.ca/dept/safety/programs-services/biosafety.html

Chemical Safety: https://www.dal.ca/dept/safety/programs-services/chemical-safety.html

Radiation Safety: https://www.dal.ca/dept/safety/programs-services/radiation-safety.html

Scent-Free Program: https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.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**