Instructor:
Michael Dowd
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Office: Chase 116

Office Hours: TBA

Stuart Carson
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Office: Chase 113

Office Hours: TBA

Lectures:
Section 1: MWF 13:30-14:30, LSC C242
Section 2: MWF 10:30-11:30, LSC C332

Tutorial: Thursday, 16:30-17:30, Dunn 117
Course Description

This course introduces a number of techniques for data analysis and inference commonly used in the experimental sciences. Topics covered include simple and multiple regression, one-way and two-way analysis of variance, and parametric and non-parametric statistics (see detailed list of topics later in this document).

Course Prerequisites

STAT 1060 or STAT 2060

The material you are expected to be familiar with is the following. The computation and use of various measures of central tendency and variability; the preparation and interpretation of graphical displays of data such as boxplots, histograms and scatterplots; the normal and t distributions and the use of tables for these distributions; the difference between populations and samples, parameters and estimates; the concept of sampling distributions and why they are important; the construction and interpretation of confidence intervals; the elements of hypothesis testing; the formation of null and alternative hypotheses and the computation and interpretation of p-values.

Course Objectives & Learning Outcomes

The main objective of this course is to provide a solid practical grounding in practical data analysis and common statistical methods that one will encounter in scientific research. Towards this end the central emphasis of the course is on Analysis of Variance (ANOVA) and Regression.

Outcomes

- A full understanding of the statistical comparison of two means using both parametric and non-parametric methods
- A thorough understanding of one-way and two-way analysis of variance (including assumptions, setup, calculations of key quantities, interpretation, and post-hoc diagnostics).
- A thorough understanding of correlation as a measure of dependence, including both parametric (Pearsons) and non-parametric (Spearmans) measures of correlation.
- A basic understanding of regression methods for both simple linear regression and multiple regression (assumptions, key quantities and formulae, implementation, interpretation, and graphical assessment via residuals)
- Experience in the statistical analysis of categorical/count data in one-way and two-way tables (e.g. chi-squared tests and contingency tables).
- The ability to use and interpret output from modern statistical software (MINITAB)
Course Materials

- There is no required text for this course. However, a detailed set of course notes will be provided. It is suggested that the books used recently in STAT 1060 (*Stats, Data and Models* by DeVeaux, Velleman and Bock), and STAT 2060 (*Probability and Statistics* by J. Devore) will provide further information on the course topics.
- There is a website for the course (details TBA). This is where class notes, announcements, etc will be posted. Marks will be disseminated via the LON-CAPA learning environment used for assignments and midterms (see below).
- The Minitab statistical package will be used in the course. It will be required for portions of some assignments. Minitab is also available in Campus computer labs. Minitab for Windows is available to students through Dalhousie ITS free of charge (PC only). Note: Minitab released a new product, Minitab Express, for both PC and Mac but it does not have the full complement of statistical features available in Minitab and is not suitable for the course.
- The LON-CAPA (Learning Online Network with Computer-Assisted Personalized Approach) e-learning software will be used for assignments, and for the midterms (as well as for disseminating assignment and midterm marks). LON-CAPA can be accessed from the BbLearn course space, or directly at [capa.mathstat.dal.ca](http://capa.mathstat.dal.ca). Details on its use will be provided at the beginning of the course.

Course Assessment

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight (% of final grade)</th>
<th>Date</th>
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<tbody>
<tr>
<td><strong>Midterm 1</strong></td>
<td>15%</td>
<td><em>Thursday, Oct 13, 1730-1900</em></td>
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<tr>
<td><strong>Midterm 2</strong></td>
<td>15%</td>
<td><em>Thursday, Nov 17, 1730-1900</em></td>
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<tr>
<td><strong>Final exam</strong></td>
<td>45%</td>
<td><em>(Scheduled by Registrar, exam period)</em></td>
</tr>
<tr>
<td><strong>Assignments</strong></td>
<td>25%</td>
<td><em>weekly to bi-weekly</em></td>
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- The midterms (80 minutes each) are scheduled OUTSIDE OF CLASS TIME on October 13 and November 17 from 5:30PM – 7:00PM. They are computer based and use the same CAPA software you will be using for your assignments. The exams will take place in computer labs in the Dunn and McCain buildings (details TBA).
- Note that since extra hours outside class time will be required for the midterms, classes may be cancelled to accommodate this. Any dates of these cancelled classes will be announced in class when midterm time approaches.
- Assignments are computer-based and will be done using the CAPA software. These will be due on a roughly weekly to biweekly basis, depending on class progress and midterms.

Other course requirements

There is a weekly tutorial that takes place Thursdays 4:30-5:30PM in Dunn 117. There are no marks associated with this tutorial. The tutorial will be given by the Teaching Assistant for the course. Its
primary purpose is the review assignment materials, and to provide assistance with MINITAB. Tutorials are not mandatory, but you are strongly encouraged to attend.

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

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range</th>
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<tbody>
<tr>
<td>A+</td>
<td>(90-100)</td>
</tr>
<tr>
<td>A</td>
<td>(85-89)</td>
</tr>
<tr>
<td>A-</td>
<td>(80-84)</td>
</tr>
<tr>
<td>B+</td>
<td>(77-79)</td>
</tr>
<tr>
<td>B</td>
<td>(73-76)</td>
</tr>
<tr>
<td>B-</td>
<td>(70-72)</td>
</tr>
<tr>
<td>C+</td>
<td>(65-69)</td>
</tr>
<tr>
<td>C</td>
<td>(60-64)</td>
</tr>
<tr>
<td>C-</td>
<td>(55-59)</td>
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<tr>
<td>D</td>
<td>(50-54)</td>
</tr>
<tr>
<td>F</td>
<td>(&lt;50)</td>
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</tbody>
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Course Policies

- **Assignments**: late assignments will receive a zero grade.

- **Midterms**: Since the midterms are scheduled outside of class time, a small number of people may have a legitimate conflict with the time of the midterm exam (this means another course or an exam scheduled for the same time), inform me at least 3 weeks in advance of the exam with details of the conflict. Please plan ahead! If an exam is missed for medical reasons, you must contact us either before, or within 24 hours of the exam, to inform us you have missed the exam. Documentation for your absence (e.g. medical) must be provided within 48 hours. If an exam is missed without a valid reason, I reserve the right to assign a zero grade for the missed midterm. Makeup midterms will be scheduled on a case-by-case basis.

- **Final Exam**: I must be informed in advance of non-attendance for the final exam. Proper written documentation of your absence is required within 24 hours.

- Other information relevant to class logistics will be communicated via messages on the course website.

Course Content

Listed below are the topics to be covered. Note that these may be altered slightly as the term progresses.

- Inference: hypothesis testing and confidence intervals
- Comparison of two means - paired samples and independent samples
- Comparison of two means - permutation test, Wilcoxon rank-sum test
- One way analysis of variance
- Bonferroni method for multiple comparisons
- Assessing the model assumptions - residual plot
- Non-parametric one way ANOVA - Kruskall-Wallis test
- Two way ANOVA without interaction
- Two way ANOVA, with interaction, Randomized block design, Post-hoc comparisons of means
- Categorical data, multinomial distribution and goodness of fit test
- $\chi^2$ tests and contingency tables
- Scatterplots, Pearson’s correlation, Spearman’s rank correlation
- Regression and least squares estimates
• Coefficient of determination, Residual plots, remedies and transformation
• Inference in regression
• Multiple regression basics, hypothesis testing and inference
• Issues in multiple regression
• ANOVA using regression
• Special topics and review

Extra Help

The Mathematics and Statistics Student Resource Centre is in Room 119 of the Chase building. Please refer to the website www.dal.ca/faculty/science/math-stats/about/learning-centre.html for more information. Tutors with expertise in Statistics will be there and available to answer questions (on a first come first served basis). There are large tables available for groups to work together. THIS IS YOUR PRIMARY SOURCE FOR EXTRA HELP – make good use of it!

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.

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:
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.

<table>
<thead>
<tr>
<th>Service</th>
<th>Support Provided</th>
<th>Location</th>
<th>Contact</th>
</tr>
</thead>
</table>
| 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:  
| 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 |