

Faculty of Science Course Syllabus (revised June 2020)
Department of Mathematics and Statistics
STAT 4350/5350 Applied Multivariate Analysis
Fall, 2020 (online)

Instructor: (Sofie) Yuan Yan **Email:** yuan.yan@dal.ca (Please put 'STAT4350' in the subject)

Office Hours (online via Collaborate Ultra): **Mon 10-11AM & Wed 4-5PM** **TA:** TBD

Lectures (asynchronous): Two video lectures will be uploaded in Brightspace every Tuesday and Thursday

Tutorial: A tutorial to review matrix theory if needed

Course Description

The course deals with the stochastic behaviour of several variables in systems where their interdependence is the object of analysis. Greater emphasis is placed on practical application than on mathematical refinement. Topics include classification, principal analysis, categorized data, analysis of interdependence, structural simplification by transformation or modelling and hypothesis construction and testing.

Course Prerequisites

Either (a) STAT3340 (Regression and Analysis of Variance), MATH2135 (Linear Algebra) or MATH2040 (Matrix Theory and Linear Algebra II)
Or (b) permission of the Instructor

Learning Objectives

The course has two main learning objectives:

I: Given a multivariate data set, the student will be able to (i) visualize it, (ii) perform an exploratory data analysis to identify potentially important inter-relationships, and (iii) fit and rigorously evaluate models.

II: Given a problem requiring the analysis of multivariate data, the student will be able to (i) identify the most relevant statistical methods to apply, (ii) be aware of their limitations, and (iii) understand the basic statistical theory underpinning the selected methods.

Course Materials

- Required textbook: Johnson and R., Wichern, D. (2007), **Applied Multivariate Statistical Analysis**, 6th ed. Pearson Prentice Hall (can be ordered and purchased from the bookstore).
- Reference textbook: Izenman, Alan Julian (2008), **Modern Multivariate Statistical Techniques**, Springer Texts in Statistics (digital book available from the library website).
- Course Brightspace: video lectures, slides, quizzes, assignments, selected old exams and R codes

Course Assessment

Component	Weight	Date
Quizzes	10%	Ongoing (<i>will be open for 48 hours after each lecture</i>)
5 Assignments	30%	Biweekly
Midterm Exam	30%	Oct. 30th 2020 (<i>will be open for 24 hours to complete</i>)
Final Project	30%	Due Dec. 15th 2020

Course Participation and Quizzes

In order to help students maintain a regular pace of learning during the semester of online teaching, quizzes are simple (non-technical) questions intended to check participation in uploaded video lectures. After each video lecture posted at **10AM AST on Tuesdays and Thursdays**, students must complete a quiz which **will remain open for 48 hours**. Only one attempt is allowed per quiz.

Assignments

Assignments will be posted one week prior to the due date in Brightspace. Assignments submission will close at **11:59PM AST** on the due date. Assignments will be graded and returned the following week. Students are encouraged to discuss with their peers for assignments, though each student will need to submit their own work.

Midterm Exam

The midterm exam will be posted in Brightspace at **10AM AST Oct. 30th 2020 (Fri)** and **will remain open for 24 hours to complete**. The midterm exam will be open-book but must be done independently. You must **not** work with your peers – anyone caught doing so will be taken to Academic Integrity.

Final Project

Students will submit a written statistical report of application of multivariate techniques to analyse a data set. The report can be done either **individually or in a group of two** for undergraduate students and **must be done individually** for Graduate students. The report should be structured in sections (e.g. motivation/background, methods, conclusion/discussion) and should not exceed 10 pages. Data sets will be provided for undergraduate students to choose from. Graduate students are responsible for finding your own data. Project report submission will close at **11:59PM AST Dec. 15th 2020 (Tue)**.

Course Content

Week	Focus Topic (Tentative)	Tasks
1	Introduction and Matrix Algebra	
2	Random Vectors	Assignment 1 due
3	Principal Component Analysis (PCA)	
4	Principal Component Analysis (PCA)	Assignment 2 due
5	The Multivariate Normal Distribution	
6	Inferences about a Mean Vector	Assignment 3 due
7	Multivariate Linear Regression	
8	Discrimination and Classification	Midterm Exam
9	Discrimination and Classification	Assignment 4 due



Week	Focus Topic (Tentative)	Tasks
10	Study Break	
11	Clustering	
12	Canonical Correlation Analysis (CCA)	Assignment 5 due
13	Factor analysis	
14		Final Project

Course Policies

- Late and missed quizzes, assignments and project report will not be accepted, unless pre-approved by instructor.
- There will only be a make-up of the midterm exam in case of illness or family emergencies.
- Office hours will be held on Collaborate Ultra found in Brightspace.
- All questions regarding this course must be asked on the Brightspace discussions threads. Please read all previously asked questions before you post. No questions asked via email will be answered.

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)		

University Policies and Statements

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

Missed or Late Academic Requirements due to Student Absence

As per Senate decision instructors may not require medical notes of students who must miss an academic requirement, **including the final exam**, for courses offered during fall or winter 2020-21 (until April 30, 2021). Information on regular policy, including the use of the Student Declaration of Absence can be found here: https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html.

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 or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).

Information: https://www.dal.ca/campus_life/communities/indigenous.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

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>

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Black Students 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 & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html

Student Advocacy: <https://dsu.ca/dsas>

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

Safety

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>