

University of Manitoba
Department of Statistics

STAT 3690 – Multivariate Analysis

Winter Term 2024

Course Details

Course Number & Title	STAT 3690, Multivariate Analysis
Section & CRN	Section A01, CRN: 59793
Class Schedule	Monday/Wednesday/Friday 9:30 AM to 10:20 AM
Class Location	Buller 315
Prerequisites	[STAT 2800, former STAT 3400, or former STAT 3500] AND [STAT 3450, former STAT 3120, or former STAT 3470] AND [MATH 2150, MATH 2151, MATH 2720, MATH 2721, or former MATH 2750] OR the consent of instructor.

Instructor Contact Information

Instructor	Dr. Elif Acar
Office Location	369 Machray Hall
Office Hours	Monday/Wednesday 10:30 AM – 11:30 AM
Email	elif.acar@umanitoba.ca I generally respond to emails within 2 business days, and only to those from UMNNetID addresses.

Student Learning Objectives

This course aims to provide students with a broad overview of techniques used in multivariate statistical analysis, including multivariate regression, principal component analysis, factor analysis, and canonical correlation analysis. The course will further prepare students for higher-level courses such as STAT 4250 Statistical Learning.

At the end of the course, students will be able to

- Make decisions on how and when to use the learned techniques,
- Apply and assess multivariate methods on real data,
- Make sound statistical conclusions based on a multivariate analysis.

The course also aims to make students competent with the R statistical software.

Course Material and Technology

Textbook	<p><i>Applied Multivariate Statistical Analysis</i> (6th ed.) by R. A. Johnson and D. W. Wichern, Prentice Hall, 2007.</p> <p>The textbook is not required but strongly recommended. A hard-copy will be available on course reserve.</p>
Course Material	Lecture slides, codes, and any additional material will be made available on UMLearn .
Supplementary Texts	<p><i>An Introduction to Applied Multivariate Analysis with R</i>, B. Everitt and T. Hothorn, Springer, 2011.</p> <p><i>Methods of Multivariate Analysis</i>, A.C. Rencher and W.F. Christensen, Wiley, 2012.</p> <p>E-books are available through the University of Manitoba Libraries.</p>
Software	The course requires you to make extensive use of the R statistical software for your assignments and final data project. You can download R at http://cran.r-project.org/

Course Assessment

Assignments	<p>There will be three assignments during the term, worth a total of 30% (each 10%) of the final grade.</p> <p>Students are encouraged to form study groups to discuss assignment questions but not the answers. Each student must submit his or her own individual written work. Copying, in whole or in part, the work of another will not be tolerated and will result in disciplinary action (see Academic Integrity section). Assignments should be handed in electronically via UMLearn or Crowdmark on the due date. Late submissions will be penalized by 25% per day. Assignments submitted more than 48 hours after the deadline will not be accepted.</p>
Term Tests	<p>There will be two term tests. They are tentatively scheduled to be held during class time on Friday, February 16 and Monday, March 25. Each test will be worth 20% of the final mark, for a total of 40%. Test content is defined by the lecture notes along with the relevant chapters from the textbook. There will be no make-up tests. If you miss a test with a valid reason and inform me within 48 hours, the weight of the test will be shifted to the other. If you miss both tests, your term test grade will be zero.</p>
Final Exam	There will be no final exam in this course.
Final Project	The data project will be a team project, where students will analyze real data using the techniques covered in the course. Teams will find their multivariate dataset for the project and detail their multivariate analysis in a project report (contributing 20% to final grade) to be submitted by April 15 . Part of the last two weeks' classes will be devoted to group presentations (contributing 10% to final grade). Detailed guidelines about the project will be provided in class.

**Grading
Timeline**

Work will be graded and returned within two weeks of submission.

Course Evaluation and Grading Scheme

Final Marks

The final mark for the course will be based on the following components.

Assignments (3)	30%
Term Tests (2)	40%
Final Project	30%

Letter Grades

The following cutoffs will be used when assigning the letter grades.

Letter Grade	Mark out of 100
A+	90 – 100
A	80 – 90
B+	75 – 80
B	70 – 75
C+	65 – 70
C	60 – 65
D	50 – 60
F	below 50

I might elect to use lower thresholds for some letter grades if I think they are more appropriate. I will not use higher thresholds.

Outline of Topics

The course is expected to cover the following topics.

1. Matrix algebra and random vectors (J&W Chapter 2)
2. Basic concepts in statistical modelling (J&W Chapter 3)
3. Multivariate normal distribution (J&W Chapter 4)
4. Inference on a mean vector (J&W Chapter 5)
5. Comparisons of multiple multivariate means (J&W Chapter 6)
6. Multivariate linear regression (J&W Chapter 7)
7. Principal component analysis (J&W Chapter 8)
8. Factor analysis (J&W Chapter 9)
9. Canonical correlation analysis (J&W Chapter 10)

Important Dates

The following dates are important to how the course will progress throughout the term.

Date	Information
Jan 8	First lecture
Jan 19/22	Last date to drop/add courses
Feb 16	Tentative date for Term Test 1
Feb 19-23	Winter term break
March 20	Last day to VW
March 25	Tentative date for Term Test 2
March 29	Good Friday (no class)
April 1-10	Group presentations
April 10	Last lecture
April 15	Final project report
April 12-26	Final examination period

The dates for the term tests are tentative, and subject to change at my discretion and/or based on the learning needs of the students. Changes are subject to Section 2.8 of the ROASS Procedure.

Student Illness

Refer to the *Short-Term Academic Accommodations* section in the Appendix. No medical notes are required for absences up to 120 hours, but you are required to submit a self-declaration for brief and temporary student absences form to me. For absences over 120 hours, a medical note will be required. Please refer to the Course Assessment section for policy regarding assessments that cannot be completed due to illness.

Instructor Illness

In the event that I become ill, I will work with the Department of Statistics to find a substitute to continue teaching in-person. In the event that a suitable instructor cannot be found, I may provide an online lecture and upload the recording to UM Learn. I will make sure to send an email to your UM email, as well as post an announcement on UM Learn.

Class Communications

The University requires all students to activate an official University email account. All communications between yourself and your instructor must comply with the Electronic Communication with Students Policy, which can be found at https://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html

Academic Integrity

It is important that you understand what constitutes academic dishonesty and that you are familiar with the very serious consequences. Links to resources that describe academic dishonesty (including plagiarism, cheating, inappropriate collaboration and examination impersonation, as well as typical penalties) can be found at <https://umanitoba.ca/student-supports/academic-supports/academic-integrity>.

Use of genAI Tools

Students may choose to use generative artificial intelligence (genAI) tools as they work through the assignments in this course. However, any such use must be fully documented in an appendix for each assignment. The documentation must include the complete set of prompts and corresponding outputs. Failing to do this will be considered as academic integrity violation.

Copyrighted Material

Please respect copyright rules during this course. All course notes, assignments, computer codes and solutions are the intellectual property of your instructor and the University of Manitoba. We will also use other copyrighted content in this course. I will ensure that the content I use is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted work must not be distributed in any format without permission. More details are available online at <http://umanitoba.ca/copyright/>.

Recording of Class Lectures

Your instructor and the University of Manitoba hold copyright over the course materials, presentations and lectures which form part of this course. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without my permission.

Student Accessibility Services

If you are a student with a disability, please contact Student Accessibility Services (SAS) for academic accommodation supports and services such as note-taking, interpreting and assistive technology. For details, please visit <https://umanitoba.ca/student-supports/accessibility>.

ROASS Schedule A

Schedule “A” of the *Responsibilities of Academic Staff with regards to Students* (ROASS) policies of the University of Manitoba lists resources and policies for students. It is important that you familiarize yourself with these resources and policies. This document is available at <https://umanitoba.ca/governance/governing-documents-students>.

University of Manitoba Acknowledgement of Traditional Territories

The University of Manitoba campuses are located on original lands of Anishinaabeg, Cree, Oji-Cree, Dakota, and Dene peoples, and on the homeland of the Métis Nation.

We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of reconciliation and collaboration.