University of Manitoba
Department of Statistics

STAT 3690 — Multivariate Analysis

Winter Term 2022

Course Details

Course Number & Title: STAT 3690, Multivariate Analysis

Section & CRN: Section A01, CRN: 59793

Course Schedule: Monday/Wednesday/Friday, 9:30 – 10:20 a.m.

Prerequisites: Necessary knowledge on statistical inference, linear algebra and R software: [STAT 2800, the former STAT 3400, or the former STAT 3500] AND [STAT 3450, the former STAT 3120, or the former STAT 3470] AND [MATH 2150, MATH 2151, MATH 2720, MATH 2721, or the former MATH 2750] OR the consent of instructor.

Instructor Contact Information

Instructor: Zhiyang Zhou

Office Location: 330 Machray Hall

Phone: (204) 480-1060

Email: zhiyang.zhou@umanitoba.ca
(I will merely respond to emails from University of Manitoba email boxes.)

Office Hours: Wednesday/Friday 10:30 – 11:30 a.m. OR by appointment

Course Materials and Technology

Textbook: (Recommended but not required) R. A. Johnson & D. W. Wichern. (2007). *Applied Multivariate Statistical Analysis*, 6th Edition. London: Pearson Education.

Notes/Slides: To be posted at the instructor's homepage (`https://zhiyanggeezhou.github.io/`) and UM Learn regularly.

Software: Data analysis in the course will be implemented by using R (`http://cran.r-project.org/`) and RStudio (`https://www.rstudio.com/products/rstudio/download/#download`). In addition, R Markdown (`https://rmarkdown.rstudio.com/lesson-1.html`) may be helpful when you are drafting manuscripts containing numerical outputs and source codes. These three are all freely available for multiple platforms. Please download and install them in advance.

Course Description

This course is delivered in person on Jan. 17 – Apr. 18, 2022. Assuming the prerequisite background in Chapters 1 – 3 of textbook, if time permits, this course is expected to cover:

- multivariate normal distribution (Chapter 4),

- inference on a mean vector (Chapter 5),
- comparisons of several multivariate means (Chapter 6),
- multivariate linear regression (Chapter 7),
- principal component analysis (Chapter 8),
- factor analysis (Chapter 9), and
- canonical correlation analysis (Chapter 10).

Course Objectives

This course aims to offer you an overview of basic statistical techniques that may be used in analyzing multivariate data, including principal component analysis, factor analysis, and other commonly used multivariate techniques. Also, it will prepare you for higher-level courses such as STAT 4250 Statistical Learning. After succeeding in this course, you are able to analyze real data with appropriate strategies and accordingly get to sound statistical conclusions. Moreover, you are expected to be familiarized with R by the training in this course.

Course Assessment

Assignments: There will be four/five assignments in total. You are encouraged to discuss questions (but not answers) with peer students, whereas you must submit the written work individually. Copying, in whole or in part, the work of another will not be tolerated and will result in disciplinary action (see Academic Integrity section). Assignment due dates will be specified as soon as questions are released. **No late submission will be accepted. Punctual submissions will be graded and returned within one week.**

Midterm: One midterm exam is tentatively scheduled on Mar. 4, 2022. The testing content is defined by lecture notes along with relevant chapters of textbook. There will be no make-up test. If you miss the midterm with a reasonable cause and inform me as soon as possible (ideally within 24 hours), the weight of other assessments may be scaled accordingly.

Final Project: There is going to be no final exam. Instead, you will be required to hand in a report after analyzing a recently collected dataset. Detailed guidelines about the final project will be provided in class.

Final Grading: For each attendee of this course, the assignments, midterm and final project contribute to the final percentage score with proportion 20%, 30% and 50%, respectively. Final letter grades will be assigned based on final percentage grades per the following thresholds.

Letter Grade	Percentage Score	Letter Grade	Percentage Score
A+	[90, 100]	C+	[65, 70)
A	[80, 90)	C	[60, 65)
B+	[75, 80)	D	[50, 60)
B	[70, 75)	F	[0, 50)

Important Dates

The following schedule is subject to change at the discretion of the instructor and/or based on the learning needs of the students. But such changes are subject to Section 2.8 of ROASS.

Date	Information
Jan. 17	First day of class
Jan. 28	Last date to drop this course with a refund
Jan. 31	Last date to add this course
Feb. 21	No class (Louis Riel Day)
Feb. 22 – 25	No class (Winter Term break)
Mar. 4	Midterm (tentative and subject to change)
Mar. 30	Winter Term Voluntary Withdrawal (VW) deadline
Apr. 15	No class (Good Friday)
Apr. 18	Last day of class
Apr. 21 – May. 1	Final Exam period

Expectations and Policies

Attendance: Though there is no penalty on absence, you are expected to be present both physically and punctually. Since the course will be delivered in person without any forms of recording, there is no alternative way of attendance.

Professional Conduct: Please be familiar with the UM Respectful Work and Learning Environment (RWLE) Section 2.5(c) of the Student Non-Academic Misconduct and Concerning Behaviour Procedure that describes types of inappropriate or disruptive behaviour.

Class Communication: You are required to obtain and use the University of Manitoba email accounts for all communication with the university (including all instructors). All the communication must comply with the Electronic Communication with Student Policy.

Student Accessibility Services: The University of Manitoba is committed to providing an accessible academic community. The Students Accessibility Services (SAS) offers academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g., mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

Recording of Lectures: No audio or video recording of this material, lectures, or presentations is allowed in any format, openly or surreptitiously, in whole or in part, without permission of the instructor.

Sharing of Course Materials: Course materials (both hardcopy and digital) are for participants' private study and research, and must not be shared. They must be used in a responsible, efficient, ethical and legal manner for educational purposes only. Violation of this policy and other Academic Integrity principles, will lead to serious disciplinary action.

Voluntary Withdrawal (VW), Authorized Withdrawal (AW) and Limited Access Policies (LAP)

VW: You have the opportunity to voluntarily withdraw (VW) from this class up to Mar. 30, 2022. By then, you will have received feedback to allow you to assess your progress and determine if you are achieving the grade you are aiming for in this course. If you are unlikely to be successful in the course, or you are not achieving the grade that you are aiming for, you should consider a VW from the course. You may discuss the VW option with an academic advisor. Students enrolled in the course after the VW deadline will be assigned with final grades. See `http://umanitoba.ca/u1/know_yourself/573.html` for more details.

AW: If medical/compassionate circumstances arise in your life and prevent you from performing as you would in normal circumstances, please contact an academic advisor to discuss your options. Be prepared to provide documentation, which supports your situation. See `http://www.umanitoba.ca/student/resource/student_advocacy/authorized-withdrawal/index.html` for details.

LAP: The Senate Executive Committee approved, on behalf of Senate, that Section 2.5(a) of the Repeated Course Policy is to be suspended indefinitely. It means that you can retake the course you have decided to VW in the next semester.

Copyrights

Please respect copyright. We will use copyrighted content in this course. University guidelines state that copyrighted works, including those created by instructors, are made available for private study and research and must not be distributed in any format without permission. Since it is illegal, do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the Copyright Act applies or written permission has been confirmed. All students are required to respect copyright as per Canada's Copyright Act. Staff and students play a key role in the University's copyright compliance as we balance user rights for educational purposes with the rights of content creators from around the world. The Copyright Office provides copyright resources and support for all members of the University of Manitoba community. For more information, see the University's Copyright Office website at `http://umanitoba.ca/copyright/` or contact um_copyright@umanitoba.ca.

Academic Integrity

Academic integrity is taking responsibility for and being honest with your work and respecting the work of others. Since you are a member of the university community, I want you to learn what that responsibility and honesty entails and how to respect the work of others. The Faculty of Science continues to uphold high standards of academic integrity. I count on each of you to do your part. Impersonation, plagiarism, and using unauthorized materials are all very serious offences. When in doubt, do not hesitate to contact me to discuss what is and what is not allowed. Asking is a sign of integrity instead of a signal that you are planning to cheat. I expect you to follow the rules: ignorance is not an acceptable excuse for academic misconduct. Useful resources can be found at

`https://www.umanitoba.ca/student/resource/student_advocacy/academicintegrity/students/a-to-i-what-is-academic-integrity.html`

and

`https://www.sci.umanitoba.ca/students/undergraduate-students/academic-integrity-2/`.

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 from the Department of Statistics web page at: https://sci.umanitoba.ca/statistics/courses-and-programs/outlines/.

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.