University of Manitoba, Department Statistics

STAT 4690/ 7200 – Applied Multivariate Analysis

Winter 2013

CRN	24809/ 24813
Instructor	Dr. Elif F. Acar Machray Hall, room 348 Phone: 204-480-1820 Elif.Acar@ad.umanitoba.ca
Office hours	M W 2:30 PM–3:30 PM, or by appointment.
Lectures	M W F 11:30 AM–12:20 PM Machray Hall, room 316
Required Text	*Applied Multivariate Statistical Analysis*, 6th edition, R. A. Johnson and D. W. Wickern, Prentice Hall, 2007.
Supplementary Text	*An introduction to applied multivariate analysis with R,* B. Everitt and T. Hothorn, Springer, 2011. (e-book is available through the University of Manitoba Libraries.)

Objectives This course aims to provide students with a broad overview of techniques used in multivariate statistical analysis. Despite the course title, equal emphasis will be placed on the theoretical and applied aspects of covered techniques.

Prerequisites Students should have a good working knowledge of statistical inference and linear models: STAT 3480 (005.348) (C); and a C or better in one of MATH 2300 (136.230), MATH 2301, MATH 2352, or the former MATH 2350 (136.235); or consent of instructor. Prior programming experience in R is useful but not required. **Students are expected to fill honesty declarations for their individual and group work in this course.**

Evaluation The final grade will be based on the following components.

Assignments (× 3)	**15%**	
Data Project (Report + Presentation)	**15%**	(10% + 5%)
Midterm	**25%**	
Final Exam	**45%**	

Midterm and Final Exams

Exam content is defined by the lecture notes along with the relevant chapters from the textbook. The Midterm Exam is tentatively scheduled to be held during the class time on Wednesday, February 27, 2013. The Final Exam date will be set by the Department of Statistics and announced later in the semester. **There will no make-up exams.**

Assignments

There will be three assignments (each contributing 5% to final grade) during the term. 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 below for Academic Integrity). Assignments should be handed in at the beginning of class on the due date. **No late or email submission will be accepted**.

Data Project

The data project will be a team project, where students will analyze real data using the techniques covered in the course. Each team will consist of one graduate student enrolled in STAT 7200 and one or two undergraduate students enrolled in STAT 4690. Teams will find their multivariate dataset for the project and detail their multivariate analysis in a project report (contributing 10% to final grade) to be submitted in the third last week of the term. Part of the last two weeks' classes will be devoted to group presentations (contributing 5% to final grade), each lasting 10-15 minutes. Further details about the project will be provided in class.

Requirements for STAT 7200

Students enrolled in STAT 7200 will be required to do additional work in the form of extra assignment and exam questions appropriate at the graduate level.

Academic Integrity

The following statements are included in this course outline to draw your attention to the academic integrity policy at the University of Manitoba.

- *Plagiarism or any other form of cheating in examinations, term tests or academic work is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university).*
- *Working with other students on assignments, laboratory work, take-home tests, or on-line tests, when this is not permitted by the instructor, can constitute Inappropriate Collaboration and may be subject to penalty under the Student Discipline By-Law.*

It is your responsibility to understand the meaning and consequences of academic dishonesty. Therefore, please check:
http://www.umanitoba.ca/science/undergrad/resources/webdisciplinedocuments.html

Tentative Course Outline

Topics covered in the course include, but are not limited to, the following:

1. Aspects of multivariate analysis (Chapter 1)
   - Handling multivariate data, graphical displays, statistical distance
2. Matrix algebra and random vectors (Chapter 2)
   - Some basics, eigenvalues and eigenvectors, positive definite matrices
   - Mean vectors and covariance matrices
3. Random Samples (Chapter 3)
   - Sample geometry, characterizing random samples
4. Multivariate normal distribution (Chapter 4)
   - Definition and properties
   - Estimation and sampling distributions
5. Inference for a mean vector (Chapter 5)
   - Hotelling's T^2 and likelihood ratio tests
   - Confidence regions and multiple comparisons
6. Multivariate linear regression (Chapter 7)
   - Multivariate regression, least squares estimation and inference
7. Principal Component Analysis (Chapter 8)
   - Definition, interpretation and use of principal components

If time permits, we will also discuss multivariate distributions, dependence models and measures, and/or modern data reduction techniques.