GORDON S.
LANG
SCHOOL of BUSINESS AND ECONOMICS

Multivariate Techniques
Winter 2020
0.5 Credits

General Course Information

Instructor: Amirali Kani

Email   akani@uoguelph.ca
Office Location   *Room 213B, MacDonald Institute*
Office Hours   Thursdays 15:30-17:30 by appointment only
Department/School   Department of Management

Class Schedule: Thursdays 13:30-15:30 and 17:30-18:30

Pre-requisites:

Restrictions:

Course Description

This course provides a review of selected multivariate analysis techniques with applications to management. Students will learn to determine which multivariate technique is appropriate for a specific research problem and how to apply multivariate quantitative techniques to research questions. Topics include regression analysis, ANOVA, principal components, factor and discriminant analysis, nonmetric scaling and trade-off analysis. The course uses a hands-on approach and requires computer-program analysis.

Course Learning Outcomes

Upon successfully completing this course, you will:

Knowledge and Understanding:

1) Design experimental and survey studies

2) Analyze experimental, survey, or secondary data using multivariate research methods including Regression Analysis, Moderation and Mediation, Analysis of Variance, Discrete Choice Analysis.

Discipline/Professional and Transferable Skills:

3) Replicate existing research findings in multivariate research methods.

Attitudes and Values

4) Behave and apply ethical standards when conducting and reporting academic and applied research.

Summary of Course Content and Materials

Week and Module (and Labs)	Lecture Topics & Readings
Week 1-3: Regression Analysis Lab Week 1: Introduction to SPSS, Binary & Effect coding, Regression analysis Lab Week 2: Regression with Categorical Explanatory Variables & log transformed variables Lab Week 3: Regression with Categorical Dependent Variable - Logistic Regression	• Introduction to Multivariate Data Analysis and Techniques • Multiple Regression Analysis, Diagnostics & Assumptions • Regression with transformed (e.g. log) independent and dependent variables: performance and cost curve models • Regression with categorical explanatory variables • Regression with categorical dependent variable: Logistic Regression • Discussion: regression with other dependent variables (e.g. count, time, repeated measures) • Association vs. Causation: Confounding and Endogenous selection bias Reading: Introduction • Whetten, D. A. (1989). What constitutes a theoretical contribution?. *Academy of management review*, *14*(4), 490-495. Readings: Simple and Multiple Regression • James et al. (2013), Chapter 3: Linear Regression; Chapter 4.3: Logistic Regression Readings: Log transformed DV and IVs – cost/performance curve models • Nagy, B., Farmer, J. D., Bui, Q. M., & Trancik, J. E. (2013). Statistical basis for predicting technological progress. *PloS one*, *8*(2), e52669. • Funk, J. L. (2015). Thinking about the future of technology: Rates of improvement and economic feasibility. *Futures*, *73*, 163-175. Readings: Logistic Regression • Peng, CJ, Lee, KL and Ingersoll, GM. (2002). An Introduction to Logistic Regression Analysis and Reporting. The Journal of Educational Research, 96 (1), 3- 14. • James et al. (2013), Chapter 4.3: Logistic Regression • Hosmer and Lemeshow (2000) Chapter 1: Introduction to Logistic Regression Model; Chapter 3: Interpretation of the Fitted Logistic Regression Model

Week 4-5 :Moderation and Mediation Analysis Lab Week 4: Introduction to PROCESS and Moderation Analysis Lab Week 5: Mediation Analysis & Moderated Mediation, Mediated Moderation	• Moderation & Mediation • Moderated Mediation & Mediated Moderation • Bootstrapping and Monte Carlo Simulations • Treatment-Mediator Interaction • Sensitivity Analysis Readings: • Hayes (2013) Chapter 4: The Simple Mediation Model, Chapter 7: Fundamental of Moderation Analysis • Baron, R. and Kenny, D. (1986), The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations, Journal of Personality and Social Psychology, 51 (6), 1173-1182 • Muller, D., Judd, C. M. and Yzerbyt, V. (2005), When Moderation is Mediated and Mediation is Moderated, Journal of Personality and Social Psychology, 89 (6), 852-863. • Zhao, X., Lynch, J. and Chen, Q. (2010), Reconsidering Baron and Kenny: Myths and Truths about Mediation Analysis, Journal of Consumer Research, 37, 197-206. • Pieters, R. (2017). Meaningful mediation analysis: Plausible causal inference and informative communication. Journal of Consumer Research, 44(3), 692-716. • Islam, T., & Meade, N. (2018). The direct and indirect effects of economic wealth on time to take-off. International Journal of Research in Marketing, 35(2), 305-318.
Week 6 & 7: Experimental Designs for ANOVA, Choice Experiments Lab Week 6: Latin Squares, BIBD, Factorial designs Lab Week 8: Choice Experiments: unlabelled, Labelled & Volumetric Choice Experiments	• Designs for Analysis of Variance (ANOVA) • Between, Within, Mixed Design & Nested Design • Blocking • Latin Squares • Balanced Incomplete Block Design (BIBD) and Applications • Orthogonal /Factorial Designs for Discrete Choice Experiments • Choice experiments using BIBD • Alternative Specific Choice Experiments (LMA design) • Effect Size, Power and Sample Size Readings: • Iacobucci, D. (2016). Chapter 7: Experimental Design

	- Montgomery (1997): Chapter 5: Randomized Blocks, Latin Squares, and Related Designs, Chapter 6: Introduction to Factorial Designs - Kuehl (2000): Chapter 9: Incomplete Block Designs: An Introduction - Louviere, Hensher and Swait (2000) Chapter 4: Experimental Design, Chapter 5: Design of Choice Experiments - Aizaki et al. (2015): Chapter 3 Discrete Choice Experiments - Green (1974): On the Design of Choice Experiments Involving Multifactor Alternatives, Journal of Consumer Research, 1, 61-68.
Week 9 & 10: Analysis of Variance Lab Week 9: Analysis of Variance (ANOVA) and Diagnostics Lab Week 10: Contrasts and Simple Effects & Repeated Measures ANOVA	- Introduction to ANOVA - Simple, Main and Interaction Effects - Planned Contrasts - Multiple Comparisons – Post Hoc - Analysis of Covariance (ANCOVA) - Repeated Measures **ANOVA Readings:** - Iacobucci (2016) Chapter 3: Two-Way, Three-Way and Higher Order ANOVA; Chapter 4: Omega-squared and Effect Sizes; Chapter 5: Contrasts and Simple Effects; Chapter 8: Repeated Measures; Chapter 9: Analysis of Covariance - Keppel and Wickens (2004): Selected Chapters
Week 11, 12 & 13: Discrete Choice Analysis Lab Week 11: Discrete Choice Analysis (DCA): Data setup and Coding Lab Week 12: MNL and Managerial Insights Lab Week 13: Choice Model Extensions: Analysis of Volumetric Choice Experiment (VCE) Data	- Stated preference (SP) and Revealed preference (RP) data - Decision Making: Individual/Group/ Joint Decision Making - Concepts: Preference Stability, Preference Consistency, Heterogeneity - Preference Elicitation using different methods - Conceptual Framework : Random Utility Model Choice Models: - Multinomial Logit Models (MNL), Assumptions - Advanced Choice Models Readings: - Ryan, Gerard and Amaya (2007): Chapter 1: Discrete Choice Experiments in a Nutshell, Chapter 3: Practical Issues in Conducting a Discrete Choice Experiment - Train (2003): Chapter 2: Properties of Discrete Choice Models

	• Louviere, Hensher and Swait (2000) Chapter 2: Introduction to Stated Preference Models and Methods
	Applications:
	• Islam, T. (2014), Household Level Innovation Diffusion Model of Photo-Voltaic (PV) Solar Cells from Stated Preference Data, *Energy Policy,* 65 (February), 340- 350.
	• Russel et al. (2017), The Impact of Front-of-pack Marketing Attributes versus Nutrition and Health Information on Parents' Food Choices, Appetite 116, 323- 338.

Note: The schedule of learning activities may require modification from time to time. Any changes will be announced in class and/or on the CourseLink site. If you are registered with the Centre for Students with Disabilities and will require some form of accommodation in the completion of the required learning activities for this course, please meet with me during the first week of classes.

Course Assessment

			Associated Learning Outcomes	Due Date/ location
Assessment 1:	60%	Assignments	LO 1 - 4	*Weeks 3, 5, 7, 9, and 11*
Assessment 2:	40%	Final Project	LO 1 - 4	*Week 13*
Total	**100%**			

- For each assignment, you will get at least 7 days for submission from the assignment handover date.
- For the final project, it is your responsibility to generate research idea and data. Discuss with your possible advisers for data and project ideas to make this project more meaningful.

Teaching and Learning Practices

Lectures Each week, the first part of the class will be lectures going over the theoretical materials assigned for each week.

Labs Each week, the second part of the class will be lab studies going over the implementation and application of the theories discussed. Bring a laptop in class

with R (https://cran.r-project.org/), R-Studio (https://www.rstudio.com), and SPSS installed.

Course Resources

This course uses a variety of materials and resources. One of your primary resources will be the course website (http://courselink.uoguelph.ca). All announcements, required and recommended readings, assignments and updates will be posted here. You will also be able to access any handouts you may have missed through this site.

Recommended Text:

Regression, Moderation and Mediation
- James, G., Witten, D., Hastie, T. and Tibshirani, R. (2013), An Introduction to Statistical Learning with Applications in R, Springer, New York.
- Hayes, A. F. (2013), Introduction to Mediation, Moderation and Conditional Process Analysis - A Regression Based Approach, The Guilford Press, New York.
- Aiken, L. and West, S. (1991), Multiple Regression: Testing and Interpreting Interactions, Sage Publications, London.
- Hosmer, DW., Lemeshow, S. and Sturdivant, R. X. (2013). Applied Logistic Regression. 3rd Edition, John Wiley and Sons, New York.

Experimental Designs
- Montgomery, D. (1997), Design and Analysis of Experiments, Fourth Edition, Wiley
- Kuehl, R. (2000), Design of Experiments: Statistical Principles of Research Design and Analysis, Second Edition, Duxbury.
- Aizaki, H., Nakatani, T. and Sato, K. (2015). Stated Preference Methods using R, CRC Press

Analysis of Variance
- Keppel, G. and Wickens, T. D. (2004). Design and Analysis: A Researcher's Handbook, 4th Edition, New Jersey.
- Iacobucci, D. (2016). Analysis of Variance (ANOVA), Earlie Lite Book, Inc., Nashville, TN

Discrete Choice Analysis
- Ryan, M., Gerard, K. and Amaya, M. (2007). Using Discrete Choice Experiments to Value Health and Health Care, Springer
- Louviere, J. J., Hensher, D. and Swait, J. (2000). Stated Choice Methods: Analysis and Application, Cambridge University Press
- Train, K. (2003), Discrete Choice Methods with Simulation, Cambridge
- Aizaki, H., Nakatani, T. and Sato, K. (2015). Stated Preference Methods using R, CRC Press

Multiple Topics
- Trochim, W. (2005) Research Methods: The Concise Knowledge Base, CENGAGE Learning. Free Access: http://www.socialresearchmethods.net/kb/

Course Policies

Grading Policies

Unless you have discussed an extension well ahead of the due date with the instructor, late penalties of 5% of the total grade earned per day (including weekends) will be assigned to any assessment (i.e. deducted from the total mark). Extensions will only be granted on the basis of valid medical or personal reasons, and need to be requested via email to the instructor as soon as possible. Late assignments will not be accepted once graded assignments have been returned officially to the class at large, unless circumstances permit and alternative arrangements have been made.

Students who find themselves unable to meet course requirements by the deadlines or the criteria expected because of medical or personal reasons, should review the regulations on academic consideration in the Academic Calendar and discuss their situation with the instructor, program counselor or other academic counselor as appropriate.

http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-grds.shtml

Missed Assignments:

A grade of zero will be assigned if you fail to submit an assignment, unless you are ill or have other compassionate reasons. Please read your Calendar for the regulations regarding illness and compassionate grounds. Please note, vacation travel, moving house, or outside work commitments will not be accepted as valid reasons for missing deadlines.

If you have religious observances which conflict with the course schedule or if you are registered with Student Accessibility Services, please contact the course instructor in order to make arrangements for your assessment if appropriate.

University Policies

Academic Consideration

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, id#, and e-mail contact. See the academic calendar for information on regulations and procedures for Academic Consideration:

https://www.uoguelph.ca/registrar/calendars/graduate/2018-2019/genreg/sec_d0e2502.shtml

Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring.

University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Graduate Calendar:

https://www.uoguelph.ca/registrar/calendars/graduate/2018-2019/genreg/sec_d0e2952.shtml

Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact Student Accessibility Services as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 56208 or email sas@uoguelph.ca or see the website: https://wellness.uoguelph.ca/accessibility/

Course Evaluation Information

Please refer to the Course and Instructor Evaluation Website

Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Drop date

The last date to drop one-semester courses, without academic penalty, is April 3, 2020. For regulations and procedures for Dropping Courses, see the Academic Calendar:

https://www.uoguelph.ca/registrar/calendars/graduate/2018-2019/sched/sched-dates-f10.shtml

Date Submitted to Chair:	9/12/2019
Chair Signature (Approval):	
Date Approved by Chair:	