Statistics 9859A (Regression) Course Outline

1. General Course Information
Lectures: MWF 1:30-2:30 PM, FNB (FIMS & Nursing Building) 3210
Tutorial: Tuesday 3:30-4:30 PM, WSC 55

Prerequisite Requirements
Graduate program in the Department of Statistical and Actuarial Sciences

2. Instructor Information

A. I. McLeod

Instructor: Professor A. I. McLeod, Ph.D. (Waterloo, 1977)
Email: aimcleod@uwo.ca
Personal homepage: http://fisher.stats.uwo.ca/faculty/aim/
Office: WSC 235. Office Hours: 3-4PM MWF or by appointment.
Students must use their Western email addresses (@uwo.ca) when contacting me about administrative matters. Discussions and questions should be posed either in class, immediately after class, in the tutorial or during office hours.

3. Textbook & Course Description
Regression Modeling with Actuarial and Financial Applications by Jed Frees

We will discuss topics from this textbook that are listed in the SOA Syllabus for the SOA Statistics for Risk Modeling Examination. For details see: LINK,
https://www.soa.org/Education/Exam-Req/edu-exam-srm-detail.aspx

Datasets and R scripts are available from my homepage.

For convenience the topics in the textbook which I plan to cover and shown in Appendix A.

Appendix B shows the topics covered by the Ph.D. Qualifying Examination in Regression. Many of these topics are discussed in Frees' textbook **but not all of them will be discussed in class**.

The computing language/environment R/RStudio used in this course. RMarkdown must be used for producing reports in PDF format for the assignments.

4. Course Materials
Laptop or personal computer with R/RStudio installed is highly recommended. Computers are also available in the Statistics Department Computing Lab (WSC 258).
Students should check OWL (http://owl.uwo.ca) on a regular basis for news and updates.

I am not able to provide practice problems for the final exam. My approach is that I will develop suitable questions to test our understanding of the topics discussed in class. This is more realistic to the expectations of employers when you are in a working environment and when you are expected to learn skills on the job.

5. Methods of Evaluation

The overall course grade will be calculated as listed below:

Project	50%
Final Exam	50%

Summary Grading Rubric for Project

- 25% for choice of interesting "live" dataset
- 25% correctness and substance
- 25% organization and correct English
- 25% originality and insight

Project. Completed assignment must be uploaded to OWL 9859 Website.
No paper copies will be accepted.

6. Accommodation and Accessibility

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or supporting documentation to the Academic Counselling Office of your home faculty as soon as possible. If you are a Science student, the Academic Counselling Office of the Faculty of Science is located in WSC 140, and can be contacted at scibmsac@uwo.ca.
For further information, please consult the university's medical illness policy at http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf.
If you miss the Final Exam, please contact your faculty's Academic Counselling Office as soon as you are able to do so. They will assess your eligibility to write the Special Exam (the name given by the university to a makeup Final Exam).
You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).

7. Academic Policies

The website for Registrarial Services is http://www.registrar.uwo.ca.
In accordance with policy, http://www.uwo.ca/its/identity/activatenonstudent.html,
the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.
No electronic devices are permitted on quizzes or the final exam. Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at this website: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

8. Support Services

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 ext. 82147 if you have questions regarding accommodation.
The policy on Accommodation for Students with Disabilities can be found here:
www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_disabilities.pdf
The policy on Accommodation for Religious Holidays can be found here:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf
This course is supported by the Science Student Donation Fund. If you are a BSc or BMSc student registered in the Faculty of Science or Schulich School of Medicine and Dentistry, you pay the Science Student Donation Fee. This fee contributes to the Science Student Donation Fund, which is administered by the Science Students' Council (SSC). One or more grants from the Fund have allowed for the purchase of equipment integral to teaching this course. You may opt out of the Fee by the end of September of each academic year by completing paperwork in the Faculty of Science's Academic Counselling Office. For further information on the process of awarding grants from the Fund or how these grants have benefitted undergraduate education in this course, consult the chair of the department or email the Science Students' Council at ssc@uwo.ca.

Appendix A. Textbook Coverage

1 Regression and the Normal Distribution
Overview
Part I Linear Regression
2 Basic Linear Regression
2.1 Correlations and Least Squares
2.2 Basic Linear Regression Model
2.3 Is the Model Useful? Some Basic Summary Measures
2.4 Properties of Regression Coefficient Estimators
2.5 Statistical Inference
2.6 Building a Better Model: Residual Analysis
2.7 Application: Capital Asset Pricing Model
2.8 Illustrative Regression Computer Output
3 Multiple Linear Regression – I
3.1 Method of Least Squares
3.2 Linear Regression Model and Properties of Estimators
3.3 Estimation and Goodness of Fit
3.4 Statistical Inference for a Single Coefficient
3.5 Some Special Explanatory Variables
5 Variable Selection
5.1 An Iterative Approach to Data Analysis and Modeling
5.2 Automatic Variable Selection Procedures
5.3 Residual Analysis
5.4 Influential Points
5.5 Collinearity
5.6 Selection Criteria
5.7 Heteroscedasticity
6 Interpreting Regression Results
6.1 What the Modeling Process Tells Us
6.2 The Importance of Variable Selection
6.3 The Importance of Data Collection
Part II Topics in Time Series
7 Modeling Trends
7.1 Introduction
7.2 Fitting Trends in Time
7.3 Stationarity and Random Walk Models
7.4 Inference Using Random Walk Models
7.5 Filtering to Achieve Stationarity
7.6 Forecast Evaluation

8 Autocorrelations and Autoregressive Models
8.1 Autocorrelations
8.2 Autoregressive Models of Order One
8.3 Estimation and Diagnostic Checking
8.4 Smoothing and Prediction
9 Forecasting and Time Series Models
9.1 Smoothing with Moving Averages
9.2 Exponential Smoothing
9.3 Seasonal Time Series Models
9.4 Unit Root Tests
9.5 ARCH/ GARCH Models
Part III Topics in Nonlinear Regression
11 Categorical Dependent Variables
11.1 Binary Dependent Variables
11.2 Logistic and Probit Regression Models
11.3 Inference for Logistic and Probit Regression Models
11.4 Application: Medical Expenditures
11.5 Nominal Dependent Variables
11.6 Ordinal Dependent Variables
12 Count Dependent Variables
12.1 Poisson Regression
12.2 Application: Singapore Automobile Insurance
12.3 Overdispersion and Negative Binomial Models
12.4 Other Count Models
13 Generalized Linear Models
13.1 Introduction
13.2 GLM Model
13.3 Estimation
13.4 Application: Medical Expenditures
13.5 Residuals
13.6 Tweedie Distribution

Appendix B

Qualifying exam syllabus for Regression

2017 Department of Statistical and Actuarial Sciences

References

Montgomery, D. C., Peck, E. A., & Vining, G. G. (2012). *Introduction to linear regression analysis,* 5th Ed. John Wiley & Sons.

Abraham, B., & Ledolter, J. (2006). *Introduction to regression modeling*. Thomson Brooks/Cole.

Topics covered

1 The simple linear regression model

2 The multiple linear regression model

3 Model adequacy checking

4 Transformations and weighting

5 Leverage, and influence diagnostics

6 Polynomial and nonparametric regression

7 Indicator variables

8 Variable selection and model building strategies

9 Multicollinearity