DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus
Department of *Mathematics and Statistics*
ACSC/Stat 4703
Regression and Analysis of Variance
Fall, 2025

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

We acknowledge the histories, contributions, and legacies of the African Nova Scotian people and communities who have been here for over 400 years.

Instructor: Bruce Smith bruce.smith@dal.ca

Lectures: MWF 2:30-3:30 , LSC 234

Office hours: Tuesday, Thursday 1:00-2:30, Chase 319

Course delivery: In person. Lectures will NOT be recorded.

Course Description:

This course focuses on the development of statistical methods for the estimation and validation of actuarial models. Topics to be discussed include: methods of estimation, properties of estimators, goodness of fit, credibility theory, survival estimators, measures of risk, estimation of severity,

Prerequisite: STAT 3703.03 or ACSC 3703.03

Course Materials

Textbook: Loss Models: From Data to Decisions (Fifth Edition) by S. A. Klugman, H. J. Panjer and G. E. Wilmot, Wiley.

Additional reading materials:

- Outstanding Claims Reserves, 2022, Hardy, M.R.
- Chapter 5 of Quantitative Enterprise Risk Management, 2022, by Hardy, M.R. and Saunders

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Component	Weight (% of final grade)	Date
Midterm exam	10%	Friday, Nov 8 (IN CLASS TIME)
Final exam	*3*0%	(Scheduled by Registrar)
Assignments	*6* assignments totalling 60%,	roughly every two weeks.

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	**B+** (77-79)	**C+** (65-69)	**D** (50-54)
A (85-89)	**B** (73-76)	**C** (60-64)	**F** (<50)
A- (80-84)	**B-** (70-72)	**C-** (55-59)	

Course Policies

Assignments are to be submitted in class on the date due.
Late assignments will not be accepted.
It is expected that each student will write up their assignment independently. Students submitting identical assignments will receive a mark of 0 for that assignment.
If you are ill on the day of a test, you must advise me of this fact before the test, and you will need to submit a Student Declaration of Absence form before you can write a make-up test.

link to University Policies and Statements

link to Student Resources

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Course Objectives/Learning Outcomes/relevant sections

1. Aggregate models:

a) Use convolution and recursive formulas to derive probability and distribution functions for aggregate claims distributions with (a,b,0) or (a,b,1) frequency, and with discrete severity distributions.

b) Derive the discretized version of a continuous distribution using the method of rounding and local moment matching.

c) Perform calculations for sums of compound Poisson models.

LMDD Sections 7.1, 7.2 , 9.3.1, 9.3.2, 9.4 (Theorem 9.7 & Example 9.9 only), 9.5, 9.6 (except 9.6.1), 9.7

2. Modeling extremes

a) Understand the derivation and characteristics of the Generalized Extreme Value and the Generalized Pareto distributions.

b) Apply the Generalized Extreme Value and the Generalized Pareto distributions to the estimation of tail risk measures and probabilities.

QERM Chapter 5

2. Construction and Selection of Parametric Models:

a) Estimate the parameters for frequency and severity distributions by maximum likelihood.

b) Estimate the variance of the estimators and construct normal and non-normal confidence intervals.

c) Use the delta method to estimate the variance of the maximum likelihood estimator of a function of the parameter(s).

d) Estimate the parameters for severity, frequency, and aggregate distributions using Bayesian Estimation.

e) Perform model selection using:

• Graphical procedures.

• Hypothesis tests, including Kolmogorov-Smirnov

, Chi-square goodness-of-fit, and Likelihood ratio (LRT) tests.

• Score-based approaches, including Schwarz Bayesian Criterion (SBC), Bayesian Information Criterion (BIC), and Akaike Information Criterion (AIC)

LMDD 11.5-11.7, 12.4, Chapter 13, Chapter 15 (except Anderson-Darling Test).

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3. Credibility

a) Explain and apply Bayesian (greatest accuracy) credibility.

b) Apply Bühlmann and Bühlmann-Straub models and understand their relationship to Bayesian models.

c) Explain and apply empirical Bayesian estimation in the nonparametric and semiparametric cases.

LMDD Chapter 18, plus review of 17.5 and 17.6

and if time permits:

4. Topic: Reserving and Pricing for Short-Term Insurance Coverages

OCR (excluding appendix)