Telephone:	(902) 494-2572
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Website:	www.dal.ca/faculty/science/math-stats.html
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Introduction

It doesn't matter if you want to design computer games, study the safety of nuclear power plants, analyze the stock market or conduct political polls: scientists of all kinds work with numbers to measure and explore the world. That's where statistics comes in. Statistics is the study of the collection, organization, analysis, interpretation and presentation of data. Extracting knowledge from data helps us plan for the future and improve our quality of life.

The Dalhousie Statistics program is the only program in the Maritimes that offers a full range of undergraduate and graduate programs. Our undergraduate courses are also approved by the accreditation committee of the Statistics Society of Canada, so that our graduates can apply for the Associate Statistician designation.

Statistics makes a great undergraduate degree with wide applicability and is an essential component of any program in the sciences or social sciences.

Degree Programs

The Department of Mathematics and Statistics offers the following degree programs in Statistics

- BSc or BA (120 credit hour) Honours (Concentrated)*
- BSc or BA (120 credit hour) Combined Honours*
- BSc or BA (120 credit hour) Major*
- BSc or BA (120 credit hour) Double Major*
- BSc or BA (90 credit hour) Minor in Statistics
- Minor in Statistics

* May be combined with Minor programs from other disciplines

Departmental requirements for each degree program can be seen by following the links in the menu to the right.

In addition to departmental requirements, students must satisfy the requirements outlined in the Academic Regulations and the College of Arts and Science Degree Requirements sections. Students are advised that a number of requirements differ for the BA and BSc degrees.

A student is governed by the academic regulations in place at the time of initial enrolment, as long as the degree is completed within the time permitted (10 years). Subsequent changes in regulations shall apply only if the student so elects. Students applying the old academic regulations should consult the calendar of the appropriate year.

Students should plan their programs of study carefully and are strongly encouraged to do so in consultation with a Statistics undergraduate academic advisor.

Staff

Dean
Moore, C., BA (Hons), PhD (Cambridge), Professor (Psychology)

Chair of the Department
Janssen, J. C., MSc (Eindhoven), PhD (Lehigh)

Director of Division
Dowd, M., PhD (Dalhousie)

Faculty Advisor
Smith, B., MSc (Calgary), PhD (Berkeley), Honours and Undergraduate Advisor, Statistics
Kenney, T., BA (Hons), MMath, PhD (Cambridge), Honours and Undergraduate Advisor, Actuarial Science

Professor Emeritus
Field, C. A., MSc, PhD (Northwestern)
Hamilton, D. C., MA, PhD (Queen's)

Professors
Beiko, R., PhD (Ottawa), cross appointment with Computer Science
Bielewski, J., MA, PhD (Texas A & M), jointly with Biology
Dowd, M., PhD (Dalhousie)
Gu, H., MSc (Peking), PhD (Hong Kong)
Mills-Flemming, J., MSc (TUNS), PhD (Dalhousie), Graduate Advisor Statistics
Sarhan, A., PhD (Gdansk)
Smith, B., MSc (Calgary), PhD (Berkeley)
Susko, E., PhD (Waterloo)
Thompson, K., MSc (Manchester), PhD (Liverpool) (CRC Chair), jointly with Oceanography
Zhao, Y., MSc (Western Kentucky), PhD (UBC), cross appointment with Management

Assistant Professors
Kenney, T., BA (Hons), MMath, PhD (Cambridge), cross appointment with Mathematics
Ho, L, PhD (Univ of Wisconsin)

University Teaching Fellows
Sarhan, A., PhD (Gdansk)

Adjunct Professors
Gupta, R. P., PhD (Delhi) Dalhousie
Herbinger, C., MSc (Paris), PhD (Dalhousie), jointly with Biology
Millar, M., PhD (Dalhousie) MSVU
Sneddon, G., PhD (Dalhousie) MSVU
Wang, X., PhD (Waterloo) St. FX

Statistical Consultant
Wang, H., PhD (Ottawa)

Please refer to the entry for the Department of Mathematics and Statistics for a full listing of the members of the Department and information on other programs offered by the Department.

BSc or BA (120 credit hour) Concentrated Honours in Statistics

Students who want a challenging program resulting in comprehensive knowledge of both theoretical and applied Statistics may want to enroll in an Honours program. Students interested in eventually pursuing graduate studies are particularly encouraged to consider Honours. Honours students must write a research-based Honours thesis. The research thesis and the Honours Qualifying Examination requirement are satisfied through completion of STAT 4950.03.

Admission to Honours
Students must apply for admission to Honours programs. Students considering Honours in Statistics should consult with a Statistics Honours Advisor early in their studies.

Departmental requirements
In addition to fulfilling the requirements outlined in the Academic Regulations and College of Arts and Science Degree Requirementssections, students in a BSc or BA Concentrated Honours program in Statistics must complete the following courses:

1000 level

- MATH 1000.03: Differential and Integral Calculus I/MATH 1010.03: Differential and Integral Calculus II or MATH 1215.03: Life Sciences Calculus/MATH 1010.03: Differential and Integral Calculus II
- STAT 1060.03: Introductory Statistics for Science and Health Sciences[1]
- MATH 1030.03: Matrix Theory and Linear Algrbra I

2000 level

- MATH 2001.03: Intermediate Calculus I
- MATH 2002.03: Intermediate Calculus II
- MATH 2040.03: Matrix Theory and Linear Algebra II or MATH 2135.03: Linear Algebra
- STAT 2060.03: Introduction to Probability and Statistics
- STAT 2080.03: Statistical Methods for Data Analysis and Inference[3]
- STAT 2450.03 Introduction to Data Mining with R
- At least two additional statistics[4] courses at or above the 2000 level (6 credit hours)

3000 level

- STAT 3340.03: Regression and Analysis of Variance
- STAT 3350.03: Design of Experiments
- STAT 3360.03: Probability
- STAT 3380.03: Sample Survey Methods
- STAT 3460.03: Intermediate Statistical Theory
- At least two mathematics[5] courses at the 3000 level (6 credit hours)

4000 level

- STAT 4066.03: Advanced Statistical Theory I
- One of STAT 4350.03: Applied Multivariate Analysis, STAT 4390.03: Time Series Analysis and STAT 4620.03: Data Analysis

- STAT 4950.03: Honours Research Project

[1]The requirement to take STAT 1060.03: Introductory Statistics for Science and Health Sciences may be waived for students entering the program in their second year.

[3]Some students may take STAT 2080.03 in the first year of their degree program.

[4]Statistics courses are any courses listed or cross-listed as STAT. The following math courses also count as credit hours in statistics:

- MATH 2001.03: Intermediate Calculus I
- MATH 2002.03: Intermediate Calculus II
- MATH 2040.03: Matrix Theory and Linear Algebra II

[5]The 3000 level mathematics courses can be chosen from the following list, and count toward the required credit hours in statistics:

- MATH 3045: Curves and Surfaces
- MATH 3080: Introduction to Complex Variables
- MATH 3120: Differential Equations
- MATH 3140: Introduction to Wavelets
- MATH 3210: Introduction to Numerical Analysis
- MATH 3260: Applied Differential Equations
- MATH 3300: Optimization
- MATH 3330: Applied Graph Theory
- MATH 3400: Classical Game Theory
- MATH 3500X/Y.06: Intermediate Analysis
- MATH 3501: Intermediate Analysis I
- MATH 3502: Intermediate Analysis II
- MATH 3900: Financial Mathematics

BSc or BA (120 credit hour) Combined Honours in Statistics and another subject

Students who wish to study Statistics in conjunction with another subject may wish to pursue a Combined Honours degree program. The other subject may be any discipline from the Faculty of Science, the Faculty of Arts and Social Sciences, the Faculty of Computer Science, or the College of Sustainability. Statistics may be the primary subject (defined as the subject with the larger number of credits at the second year or above), or the secondary subject.

Students planning to enroll in a Combined Honours program should consult with academic advisors from both programs early in their studies. Students must have their program of study approved by Academic Advisors in both subject areas. Students must complete a research thesis and an Honours Qualifying Examination in one of the two subject areas, a requirement normally completed in the primary subject area. For Statistics, this requirement is satisfied through STAT 4950.03.

Departmental requirements

Students in a BSc or BA Combined Honours program in Statistics and another subject must fulfill the requirements outlined in the Academic Regulations and College of Arts and Science Degree Requirements sections.

- Courses must include:
- Math 1030.03: Matrix Theory and Linear Algebra I
- MATH 2001.03: Intermediate Calculus I
- STAT 2060.03: Introduction to Probability and Statistics
- STAT 2080.03: Statistical Methods for Data Analysis and Inference
- STAT 3340.03: Regression and Analysis of Variance
- STAT 3360.03: Probability
- STAT 3460.03: Intermediate Statistical Theory
- At least one STAT course (3 credit hours) at the 4000 level

If Statistics is the primary subject, students will also complete

- STAT 4950.03: Honours Research Project
- At least nine additional credit hours of Statistics[4] courses at or above the 2000 level, at least three of which must be a MATH course at the 3000 level.

If Statistics is the secondary subject, students will also complete

- At least 9 credit hours at or above the 2000 level, at least 6 credit hourse of which must be at the 3000 level (and may include a 3 credit hour 3000 level MATH course).

[4]Statistics courses are any courses listed or cross-listed as STAT. The following can also be counted towards statistics credit hours:

- MATH 2002.03: Intermediate Calculus II
- MATH 2040.03: Matrix Theory and Linear Algebra II

BSc or BA (120 credit hour) Major in Statistics

The 120 credit hour Major is suited to students who want to focus on Statistics, but wish to have a program that is somewhat less constrained than the Honours program.

Departmental requirements

In addition to fulfilling the requirements outlined in the Academic Regulations and College of Arts and Science Degree Requirements sections, students in a BSc or BA Major program in Statistics must complete the following courses:

1000 level

- MATH 1000.03: Differential and Integral Calculus I/MATH 1010.03: Differential and Integral Calculus II or MATH 1215.03: Life Sciences Calculus/MATH 1010.03: Differential and Integral Calculus II
- STAT 1060.03: Introductory Statistics for Science and Health Sciences[1]
- Math 1030.03: Matrix Theory and Linear Algebra I

2000 level

- MATH 2001.03: Intermediate Calculus I
- MATH 2002.03: Intermediate Calculus II
- MATH 2040.03: Matrix Theory and Linear Algebra II or MATH 2135.03: Linear Algebra
- STAT 2060.03: Introduction to Probability and Statistics
- STAT 2080.03: Statistical Methods for Data Analysis and Inference3
- STAT 2450.03: Introduction to Data Mining with R

3000 level

- STAT 3340.03: Regression and Analysis of Variance
- STAT 3360.03: Probability
- STAT 3380.03: Sample Survey Methods or STAT 3350.03: Design of Experiments
- STAT 3460.03: Intermediate Statistical Theory
- At least 2 additional Statistics[4] courses (6 credit hours) at or above the 3000 level, including at least one course (3 credit hours) at the 4000 level

[1]The requirement to take STAT 1060.03: Introductory Statistics for Science and Health Sciences may be waived for students entering the program in their second year.

[3]Some students may take STAT 2080.03 in the first year of their degree program.

[4]Statistics courses are any courses listed or cross-listed as STAT. The following are also counted as statistics credit hours:

- MATH 2001.03: Intermediate Calculus I
- MATH 2002.04: Intermediate Calculus II
- MATH 2040.03: Matrix Theory and Linear Algebra II

BSc or BA (120 credit hour) Double Major in Statistics and another subject

The Double Major degree program allows students to combine a study of Statistics with another subject. The other subject may be any discipline from the Faculty of Science, the Faculty of Arts and Social Sciences, the Faculty of Computer Science or the College of Sustainability. Statistics may be the primary subject (defined as the subject with the larger number of credits), or the secondary subject. If the primary subject area is from the Faculty of Arts and Social Sciences, the degree granted will be a BA.

It is recommended that students enrolled in a Double Major program consult with advisors in both subject areas.

Departmental requirements

Students in a BSc or BA Double Major in Statistics and another subject must fulfill the requirements outlined in the Academic Regulations and College of Arts and Science Degree Requirements sections.

- Courses must include:
- Math 1030.03: Matrix Theory and Linear Algebra I
- MATH 2001.03: Intermediate Calculus I

- STAT 2060.03: Introduction to Probability and Statistics
- STAT 2080.03: Statistical Methods for Data Analysis and Inference
- STAT 3340.03: Regression and Analysis of Variance
- STAT 3360.03: Probability
- STAT 3460.03: Intermediate Statistical Theory
- At least 4 additional statistics courses[4] at or above the 2000 level (12 credit hours), including at least 9 credit hours at or above the 3000 level (these 9 credit hours must comprise at least 3 credit hours of STAT, with the remaining 6 credit hours being in either STAT or MATH).

[4] Statistics courses are any courses listed or cross-listed as STAT. The following can also be counted towards statistics credit hours:

- MATH 2002.03: Intermediate Calculus II
- MATH 2040.03: Matrix Theory and Linear Algebra II

BSc or BA (90 credit hour) Minor in Statistics

The 90 credit hour Minor in Statistics is appropriate for students who want to study some Statistics but do not wish to complete the conventional four-year program. The degree is best suited for students who want a general science degree with some specialization in Statistics. A 90 credit hour degree program is not suitable for students who wish to pursue graduate studies. With additional study, the degree may be upgraded to a 120 credit hour Major or Honours degree at a later date.

A 90 credit hour BSc or BA in Statistics is usually the preferred option for students who wish to combine studies in Statistics with a degree in Engineering (see BSc/BEng or BA/BEng Concurrent Program).

See the Minor in Statistics section of this Calendar.

Minor in Statistics
This minor is available to students registered in a 120 credit hour Bachelor of Applied Computer Science, Bachelor of Arts, Bachelor of Commerce, Bachelor of Community Design, Bachelor of Computer Science, Bachelor of Informatics, Bachelor of Management, Bachelor of Music, Bachelor of Science or Bachelor of Science (Medical Sciences) program.

A BSc or BA (90 credit hour) degree program with a minor in Statistics is also available.

Requirements
A minimum of 18 to a maximum of 36 credit hours in Statistics, which must include:

- MATH 1030.03: Matrix Theory and Linear Algebra
- STAT 2060.03: Introduction to Probability and Statistics
- STAT 2080.03: Statistical Methods for Data Analysis and Inference
- STAT 3340.03: Regression and Analysis of Variance
- At least two additional statistics[1] course (6 credit hours) at the 2000 level or above
- At least one additional statistics course (3 credit hours) at the 3000 level or above

[1] Statistics courses are any courses listed or cross-listed as STAT. The following can also be counted as 2000 level statistics credit hours:

- MATH 2001.03: Intermediate Calculus
- MATH 2002.03: Intermediate Calculus II
- MATH 2040.03: Matrix Theory and Linear Algebra II
- BIOL 4062.03: Analysis of Biological Data

Contact Statistics for more information.

Co-op, Minors, Certificates and Engineering Concurrent Programs for Students

Minors available to students in Statistics
Minor programs allow students to develop subject specialties in addition to their Major or Honours subjects. Minors in other subjects are normally added to 120 credit hour BSc or BA programs.

Students in a BSc or BA (120 credit hour) program in Statistics may choose to include a Minor selected from the list of approved Minors. Courses counted toward a Major or Honours subject cannot be used to fulfill the requirements of a Minor program.

Certificates
In combination with a BSc or BA in Statistics, students may obtain one or more Certificates. A Certificate indicates that a student has achieved a certain level of proficiency in a given area or subspecialty. Courses counted toward a Major, Honours or Minor subject may also be used to fulfill the requirements of a Certificate. Students must apply to the Certificate Coordinator to be considered for a Certificate. Certificates are awarded upon graduation and are noted on the student's academic transcript.

A complete list of [Faculty of Science Certificates](#) and requirements can be found at the beginning of the [Faculty of Science](#) section. Students may also work toward obtaining Certificates offered by other Faculties; some of these are listed in the [College of Arts and Science Degree Requirements](#) section.

Certificates of particular interest to student enrolled in a BSc or BA in Statistics include:

- [Certificate in Actuarial and Financial Mathematics](#)
- [Certificate in Applied and Computational Mathematics](#)

BSc/BEng or BA/BEng Concurrent Program

Students interested in combining their interest in Program with a degree in Engineering may choose a BSc/BEng or BA/BEng Concurrent Program, normally completed in a 5 year period. Over the first three years, students complete the requirements for a 90 credit hour BSc or BA degree in Statistics and a Diploma of Engineering (the first two years of engineering studies). Two more years of engineering studies are then required to obtain a BEng. Interested students should see an undergraduate advisor from Statistics and from the Faculty of Engineering in their first year of study.

Required Statistics courses for a BSc/BEng or BA/BEng program in Statistics

- A minimum of 18 credit hours in Statistics courses at the 2000 level or higher, which must include STAT 2060.03, STAT 2080.03, STAT 3340.03 and at least one other STAT course[4] at or above the 3000 level

[4]Statistics courses are any courses listed or cross-listed as STAT. The following can also be counted towards statistics credit hours:

- MATH 2001.03
- MATH 2002.03
- MATH 2030.03
- MATH 2040.03

Courses

Below you will find descriptions for courses offered in this field of study. You will find a general overview of the topics covered and any prerequisite course or grade requirements, credit value and exclusions.

The first digit of the course indicates the general level. Those in the 1000 series are introductory degree level. Courses at the 2000, 3000, 4000 series are typically available to students in the second, third, and fourth year. Courses numbered at the 5000 level or above are graduate level. Courses listed at the 0100 or 0200 series are technology level courses. Courses below the 0100 level are generally non credit courses.

Some courses are listed as exclusionary to one another. This means that students may not obtain credit for both courses as designated.

Not all courses are offered each year. Please consult the current [timetable](#) for this year's offering. For further information please contact the department, or visit the department's website.

Course Descriptions
Course Notes
Certain courses have been approved for use in fulfilling the educational requirements of the Associate Statistician (A.Stat.) designation of the Statistical Society of Canada (SSC). See the Department or the SSC website (http://ssc.ca/en/accreditation/apply/suggested-courses-use-towards-astat-designation) for details.

Credit may not be obtained twice for the same course even if the numbers have been changed.

STAT 1060 Introductory Statistics for Science and Health Sciences
CREDIT HOURS: 3
This course gives an introduction to the basic concepts of statistics through extensive use of examples. The topics include experimental design, descriptive statistics, simple linear regression and the basics of statistical inference. Students will learn to use the statistical package MINITAB. NOTE: Students who have already taken university level Calculus should consider taking STAT 2060.03 instead of STAT 1060.03.
CALENDAR NOTES: Students will not receive credit for taking STAT 1060.03 after receiving credit for STAT 2060.03.
PREREQUISITES: Academic or advanced Grade 12 Mathematics (or pre-calculus) or equivalent
CROSSLISTED: MATH 1060.03
EXCLUSIONS: COMM 2501.03, MGMT 1501.03, DISP
FORMATS: Lecture | Tutorial

STAT 2060 Introduction to Probability and Statistics
CREDIT HOURS: 3
Rigorous introduction to probability and statistical theory. Topics covered include elementary probability, random variables, distributions, estimation and hypothesis testing. Estimation and testing are introduced using maximum likelihood and the generalized likelihood ratio. Natural sequels for this course are STAT 2080.03 and 3360.03
PREREQUISITES: MATH 1000.03 or MATH 1215.03 or MATH 1550 OR MATH 1500X/Y
CROSSLISTED: MATH 2060.03, ECON 2260.03
EXCLUSIONS: ENGM 2032.03
FORMATS: Lecture

STAT 2080 Statistical Methods for Data Analysis and Inference
CREDIT HOURS: 3
The usual sequel to STAT 1060.03 or STAT 2060.03. This course introduces a number of techniques for data analysis and inference commonly used in the experimental sciences. Topics covered include two-sample inference one-way and two-way analysis of variance, correlation, linear regression, and the analysis of categorical and count data. A natural sequel for this course is STAT 3340.03.
PREREQUISITES: STAT 1060.03 or STAT 2060.03 or DISP
CROSSLISTED: MATH 2080.03, ECON 2280.03
EXCLUSIONS: COMM 2502.03, MGMT 2502.03, PSYO 2501.03
FORMATS: Lecture

STAT 2300 Introduction to Mathematical Modelling I
CREDIT HOURS: 3
See course description for MATH 2300.03 in the Mathematics section of this calendar.

STAT 2450 Introduction to Data Mining with R
CREDIT HOURS: 3
This course provided as introduction to data mining and R programming, suited for science students. Data mining methods include a vast set of tools developed in different areas for identifying the patterns in data. Students will learn programming methods for manipulating and exploring data through learning the basic ideas of some clustering, regression and classification methods. No prior programming knowledge is assumed.
PREREQUISITES: MATH 1000.03 or MATH 1215.03 and either (STAT 1060.03 or MATH 1060.03) or (STAT 2060.03 or MATH 2060.03
FORMATS: Lecture

STAT 2600 Theory of Interest
CREDIT HOURS: 3
See course description for MATH 2600.03 in the Mathematics section of this calendar.

STAT 3340 Regression and Analysis of Variance
CREDIT HOURS: 3
A thorough treatment of the theory and practice of regression analysis. Topics include: fitting general linear models using matrices, optimality of least squares estimators (Gauss-Markov theorem), inferences, simple and partial correlation, analysis of residuals, case-deletion diagnostics, polynomial regression, transformations, use of indicator variables for analysis of variance and covariance problems, model selection, and an introduction to nonlinear least squares. This course makes extensive use of computer packages.
PREREQUISITES: STAT 2080.03, MATH 2030.03 or Math 1030.03, and one of MATH 1010.03, STAT 2060.03 or DISP (except SCIE 1540X/Y.27)
CROSSLISTED: MATH 3340.03
FORMATS: Lecture

STAT 3345 Environmental Risk Assessment
CREDIT HOURS: 3
Statistical methods for assessing risk are discussed, including dose-response models, survival analysis, relative risk analysis, bioassay, estimating methods for zero risk trend analysis and association risks. Case studies are used to illustrate the methods.
PREREQUISITES: MATH 1000.03 or MATH 1215.03, STAT 2080.03 or equivalent

STAT 3350 Design of Experiments
CREDIT HOURS: 3
The aim of the course is to develop the fundamental statistical concepts required for designing efficient experiments to answer real questions. The first main subject is unit variation and control. The basic concepts of replication, blocking and randomization are each examined. The second main subject is treatment questions and structure. The ideas of factorial designs, split-plot and incomplete plot designs are presented. We conclude with a look at response surface methodology.
PREREQUISITES: STAT 2080.03, MATH 2030.03 or Math 1030.03, and one of MATH 1010.03, STAT 2060.03 or DISP (except SCIE 1540X/Y.27)
CROSSLISTED: MATH 3350.03
FORMATS: Lecture

STAT 3360 Probability
CREDIT HOURS: 3
The concepts and application of probability. Topics include the classical discrete and continuous distributions, including the binomial, hypergeometric, multinomial, Poisson, uniform, exponential and normal; definitions and properties of random variables; independence; sums of independent random variables, including the law of large numbers and central limit theorem; conditional probability; and the bivariate normal distribution. Examples will be taken from the natural and physical sciences.
PREREQUISITES: STAT 2060.03 and MATH 2001.03
CROSSLISTED: MATH 3360.03
FORMATS: Lecture

STAT 3380 Sample Survey Methods
CREDIT HOURS: 3
The development of design and analysis techniques for sample surveys. Topics include simple, stratified and systematic random sampling, ratio and regression estimation, sub-sampling with units of equal and unequal size, double-multistage and multiphase sampling, non-sample errors and non-respondents.
PREREQUISITES: STAT 2060.03
CROSSLISTED: MATH 3380.03
FORMATS: Lecture

STAT 3460 Intermediate Statistical Theory
CREDIT HOURS: 3
This course provides an intermediate level coverage of statistical theory to provide a framework for valid inferences from sample data. The methods developed are based on the likelihood function and are discussed from the frequentist, likelihood, and Bayesian approaches. The problems of point estimation, interval estimation and

hypothesis testing and the related topics of sampling distributions, sufficiency, and Fisher Information are discussed.
PREREQUISITES: STAT 3360.03
CROSSLISTED: MATH 3460.03
FORMATS: Lecture

STAT 3703 Actuarial Models I
CREDIT HOURS: 3
This class builds on the material in STAT 3360 to develop the theoretical basis for construction and evaluation of actuarial models. Topics covered include survival models, probability distributions, deductibles and limits, and aggregate loss models, with application to insurance. This course covers the part of the syllabus for the professional actuarial examination concerned with the Construction and Evaluation of Actuarial Models.
PREREQUISITES: STAT 3360.03 OR MATH 3360.03
CROSSLISTED: ACSC 3703.03
EXCLUSIONS: STAT 4701.03
FORMATS: Lecture

STAT 3720 Life Contingencies I
CREDIT HOURS: 3
This course introduces the student to the mathematical models for valuation of life contingencies (e.g. life insurance policies). The course covers both the statistical aspects of modelling survival data, and the financial aspects of valuing uncertain future cash-flows.
PREREQUISITES: STAT 3360.03, STAT 2600.03
CROSSLISTED: ACSC 3720.03
FORMATS: Lecture

STAT 3750 Credibility Theory
CREDIT HOURS: 3
Credibility theory deals with the difficulty in combining information from two samples, one of which is small but very relevant, the other is large but less relevant. In this course, we will study different approaches to dealing with this problem.
COREQUISITES: ACSC 3703.03
PREREQUISITES: STAT 3360.03
CROSSLISTED: ACSC 3750.03

STAT 4066 Advanced Statistical Theory I
CREDIT HOURS: 3
This course, together with STAT 5067.03 provides a solid basis in the theory of statistical inference. After a review of some probability and distribution theory, the Bayesian and classical theories of estimation and testing are introduced.
PREREQUISITES: STAT 3460.03 or instructor's consent
CROSSLISTED: MATH 4066.03/5066.03, STAT 5066.03
FORMATS: Lecture

STAT 4100 Survival Analysis
CREDIT HOURS: 3
This course is an introduction to survival analysis methods and will cover both the statistical theory behind the methods, and the application of various techniques. Topics to be discussed include survivorship and hazard functions and their relationship to lifetime distributions and densities; modes of censoring; the Kaplan-Meier estimate of the survivor function; parametric survival time distributions; proportional hazard models and their semi-parametric estimation; accelerated life models, log rank tests, including the Mantel-Haenszel test; and goodness of fit measures.
PREREQUISITES: STAT 3340.03 and STAT 3460.03, or equivalent
CROSSLISTED: STAT 5100.03
FORMATS: Lecture

STAT 4130 Bayesian Data Analysis
CREDIT HOURS: 3
This course introduces the student to the Bayesian methods in applied statistics. The course covers all the fundamental concepts of Bayesian methods, and works from the simplest ideas (characterizations of probability; comparative inference; prior, posterior and predictive distributions) up through hierarchical modes applied to various data. Computational methods include MCMC for posterior simulation.
PREREQUISITES: MATH 2030.03 or Math 1030.03, and STAT 3460.03
EXCLUSIONS: STAT 5130.03
FORMATS: Lecture

STAT 4300 Topics in Statistics and Probability
CREDIT HOURS: 3
CROSSLISTED: STAT 5300.03

STAT 4350 Applied Multivariate Analysis
CREDIT HOURS: 3
The course deals with the stochastic behaviour of several variables in systems where their interdependence is the object of analysis. Greater emphasis is placed on practical application than on mathematical refinement. Topics include classification, cluster analysis, categorized data, analysis of interdependence, structural simplification by transformation or modelling and hypothesis construction and testing.
PREREQUISITES: STAT 3340.03 and MATH 2135.03 or 2040.03
CROSSLISTED: STAT 5350.03
FORMATS: Lecture

STAT 4360 Robust Statistics
CREDIT HOURS: 3
Robust statistics are those which provide protection against violation of assumptions underlying the statistical procedure. We will develop basic concepts including sensitivity, influence and breakdown of estimates and tests. Classical procedures will be evaluated in terms of robustness and alternate techniques developed based on weighted least squares and/or median based generalizations. We will also consider robust techniques in time series.
PREREQUISITES: STAT 3340.03 and STAT 3460.03
CROSSLISTED: STAT 5360.03

STAT 4370 Stochastic Processes
CREDIT HOURS: 3
The theory and application of stochastic processes. Topics to be discussed include the Poisson process, renewal theory, discrete and continuous time Markov processes, and Brownian motion. Applications will be taken from the biological and physical sciences, and queueing theory.
PREREQUISITES: STAT 3360.03 or instructor's consent
CROSSLISTED: STAT 5370.03
FORMATS: Lecture

STAT 4390 Time Series Analysis
CREDIT HOURS: 3
Time series analysis in both the time and frequency domain is introduced. The course is applied and students are required to develop their own computer programs in the analysis of real time series with an emphasis on oceanographic data. Topics to be discussed include the nature of time series, stationarity, auto and cross covariance, ARMA models, spectral analysis, and state space models (the Kalman filter and the particle filter).
PREREQUISITES: STAT 3340.03, 3360.03, STAT 3460.03, or instructor's consent
CROSSLISTED: OCEA 4210.03
EXCLUSIONS: OCEA 5210.03, STAT 5390.03
FORMATS: Lecture

STAT 4570 Statistical Genetics
CREDIT HOURS: 3
Statistical aspects of several ideas in genetics are discussed. Topics of some or all the following: gene frequency estimation, Hardy-Weinberg equilibrium, linkage analysis, association studies, quantitative traits, microarrays.
PREREQUISITES: STAT 3460 or permission of instructor
CROSSLISTED: STAT 5570
FORMATS: Lecture

STAT 4620 Data Analysis
CREDIT HOURS: 3
A variety of statistical models which are useful for the analysis of real data are discussed. Topics include: generalized linear models, such as logistic regression and Poisson regression, models for multidimensional contingency tables, ordered categories and survival data.
PREREQUISITES: STAT 3340.03, 3460.03, or instructor's consent
CROSSLISTED: STAT 5620.03
FORMATS: Lecture

STAT 4701 Actuarial Models I
CREDIT HOURS: 3
This course develops the theoretical basis of a number of probabilistic models useful for the study of life contingencies, including survival models, Markov chains, Poisson processes, with application to life insurances and annuities.
PREREQUISITES: STAT 3360.03
FORMATS: Lecture

STAT 4703 Actuarial Models II
CREDIT HOURS: 3
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 and ruin models.
PREREQUISITES: STAT 3703 or ACSC3703
CROSSLISTED: ACSC 4703.03
FORMATS: Lecture

STAT 4720 Life Contingencies II
CREDIT HOURS: 3
STAT 3720.03 covers the basics of life contingencies in a simple standard situation. In this course we extend this to deal with a number of common additional features that afect life insurance policies. We introduce multiple-state models, pensions, interest rate risk and profit testing.
PREREQUISITES: STAT 3720.03
CROSSLISTED: ACSC 4720.03
FORMATS: Lecture

STAT 4950 Honours Research Project
CREDIT HOURS: 3
This course is required for students in the honours program. It will consist of a research project carried out under the supervision of a faculty member. The results of the research will be submitted to the statistics honours advisor as a written report. Students wishing to enroll in this course must have a suitable background in statistics, and must meet with, and obtain the approval of, the statistics honours co-ordinator before undertaking their project.

STAT 8892 Co-op Work-Term II
CREDIT HOURS: 0

STAT 8893 Co-op Work-Term III
CREDIT HOURS: 0